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VA'S IT PROGRAM: LOOKING AHEAD

HEARING

BEFORE THE

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C O N T E N T S

WEDNESDAY, OCTOBER 6, 2010

SENATORS

WITNESSES

VA'S IT PROGRAM: LOOKING AHEAD

WEDNESDAY, OCTOBER 6, 2010

U.S. SENATE,
COMMITTEE ON VETERANS' AFFAIRS,
Washington, DC.

The Committee met, pursuant to notice, at 9:33 a.m., in room 418, Russell Senate Office Building, Hon. Daniel K. Akaka, Chairman of the Committee, presiding.

Present: Senators Akaka, Burr, Johanns, and Brown of Massachusetts.

OPENING STATEMENT OF HON. DANIEL K. AKAKA, CHAIRMAN, U.S. SENATOR FROM HAWAII

Chairman AKAKA. This hearing of the United States Senate Committee on Veterans' Affairs will come to order.

Today, the Committee examines VA's IT program with an eye toward the future. I thank the Ranking Member, Senator Burr, very much for his deep interest in this issue.

Many important VA benefits depend on information technology, from the delivery of quality care to the processing of education and disability claims, and to any effort to ensure seamless transition from DOD to VA. While it is true that VA has been a leader in adopting electronic health records, VA's overall history with IT projects is far from perfect. VA has stumbled over the years on its path toward the goal of an electronic VA.

More recently, we had a financial and logistics system fail known as CoreFLS. To make matters worse, the contractor was paid a bonus. Software systems processing G.I. Bill claims suffered many false starts. And last summer, VA halted 45 projects that were dramatically over budget and overdue, including an outpatient scheduling system that was 3 years overdue.

I do not wish to dwell in the past. We must, however, learn from these mistakes and take action to avert them in the future.

The administration has made it a priority to improve the delivery of veterans' benefits through technology. With appropriate technologies VA will more efficiently serve veterans by reducing the time it takes to process benefits. Moving forward, VA must clearly articulate a vision for its IT program. VA's day-to-day management must reflect this vision, and the lines of communication that compel IT development must remain open between VA leadership and users.

Every VA medical facility across the Nation must operate with a fully electronic medical record. The Lifetime Electronic Record also needs to become a reality. G.I. Bill processing software needs

to be good enough to allow veterans, the schools, and VA to access and file claims in hours instead of weeks. And we must be in line to eventually replace the paper-centric disability claims process with an electronic business solution.

This hearing is one effort among many to carry out oversight of IT. Again, I welcome everyone to today's hearing. I look forward to the testimony from our panel and to continuing work with the many interested parties as we seek to ensure VA is on the right track.

Let me call on our Ranking Member, Senator Burr, for his statement.

STATEMENT OF HON. RICHARD BURR, RANKING MEMBER, U.S. SENATOR FROM NORTH CAROLINA

Senator BURR. Aloha, Mr. Chairman.

Chairman AKAKA. Aloha.

Senator BURR. Welcome to our witnesses.

Mr. Chairman, I thank you for your willingness to schedule this hearing even though the Senate is out of session. I want to thank my colleagues, Senator Johanns and Senator Brown, for being here.

Mr. Chairman, seldom do we have a witness that you and I share from the standpoint of their State presence, but I would like to welcome Glen Tullman, the CEO of Allscripts. They have a presence in 15 States. I am proud to tell you two of those are Hawaii and North Carolina, so it is appropriate that we would have him here today and I want to thank him for taking time out of his busy schedule to discuss the company's experience with electronic health records and interoperability in the private sector.

We are here to discuss an integral tool of VA's mission, the use of technology to deliver effective benefits and services to the American veterans. Within VA, the Office of Information and Technology is responsible for the management and oversight of VA's information technology assets. With a budget of over $3 billion and a mission so important to the successful delivery of services to veterans, Congressional oversight and involvement is critical.

Today, we take a step toward strengthening the partnership between this Committee and the Office of Information and Technology in addressing the challenges confronting VA's effective management of its IT assets. We have seen a number of IT projects important to VA's mission fail and others discontinued over the last decade. These failures and discontinuations have cost taxpayers hundreds of millions of dollars. Despite continued warnings from the IG, GAO, and Members of Congress, problems delivering useful IT projects on time and on budget persist at VA. At times, these failures have left me wondering whether or not VA has the capability to deliver IT programs of significance on time, on budget, and within specifications.

However, since Mr. Baker's appointment at VA 16 months ago, there seems to be a genuine effort to overhaul this portion of VA's operations. The installation of the Project Management Accountability System by the Assistant Secretary appears to be a strong first step in reigning in out of control and oversized contracts and projects. I look forward to hearing Mr. Baker's assessments about how PMAS has affected the culture at the VA.

With today's modern technology, there are several IT capabilities that are expected from companies and health networks doing business across the country. These include the ability to process claims, schedule appointments, conduct real-time accounting, and share information seamlessly with other partners. Unfortunately, these are all areas where VA continues to struggle, oftentimes producing not a single result that was desired at the outset of the program.

One example of this is their proposed scheduling program that took 9 years, $127 million to produce nothing. VA still needs a new scheduling program in order to improve patient health care delivery at each VA facility.

The cancellation of the proposed accounting system is also concerning. Although this decision should be applauded as a sign that the VA is moving away from bloated and oversized projects and contracts, let me state that the inability to identify expenditures in real time is hamstringing VA's capability to know how much their cost of conducting business really is.

Interoperability with DOD is another area that continues to need improvement. As witnesses will testify, the capability to share information across systems is available, but to date, it appears that even though there has been nominal success by VA, we are far from where we need to be.

I look forward to hearing specifically where VA currently stands with regard to having the appropriate technological capabilities to deliver veterans the time-sensitive services that they have earned, and more importantly, they deserve.

Again, I thank you, Mr. Chairman. I thank our witnesses.

Chairman AKAKA. Thank you very much, Senator Burr.

Now we will have the opening statement from Senator Johanns.

STATEMENT OF HON. MIKE JOHANNS, U.S. SENATOR FROM NEBRASKA

Senator JOHANNS. Mr. Chairman and Ranking Member, thank you very much for putting this hearing together and welcome to the witnesses.

As I was listening to the Chairman and Ranking Member speak, I thought back to my days as Secretary of Agriculture, and I have to tell you, IT systems were the bane of my existence. [Laughter.]

So I start out telling you that because I think I understand what you are going through here.

This is not a good history. There is just no way of getting around it. It is frustrating to me as it is to you, I am sure, that projects come in over budget; that after working on a project and spending enormous amounts of money, the project is abandoned.

The other thing that is a little harder to quantify but is enormously real is the amount of staff time that is invested. Again, that is just very, very difficult to quantify, but those staff members who are committing their time to a project are not doing other things, and so they are constantly playing catch-up.

So, I think this hearing is enormously important. I will say this, Secretary Baker, I do think you are trying to get on top of this and I think you are trying to move in the right direction. My hope for today's hearing is that we get an honest assessment from all the witnesses as to where we are at to date, and although it is never

pleasant to talk about the problems that are out there that you know are going to end up on our desk and then your desk, I would like to hear some thoughts about where we are as we head toward the future here.

So, Mr. Chairman and Ranking Member, thanks for pulling this hearing together. I look forward to the testimony.

Chairman AKAKA. Thank you very much, Senator Johanns.

Now we will have the opening statement of Senator Brown of Massachusetts.

STATEMENT OF HON. SCOTT BROWN, U.S. SENATOR FROM MASSACHUSETTS

Senator BROWN OF MASSACHUSETTS. Thank you, Mr. Chairman. I concur with the opening statements of the Ranking Member, Senator Johanns, and yourself: I am here to learn and to see what tools and resources we can either provide or are needed to do your job better for the folks that need your help. So thank you.

Chairman AKAKA. Thank you very much, Senator Brown.

I want to welcome the witnesses on today's panel. In the interest of opening a dialog amongst our witnesses, we have only one panel.

First, we have the Honorable Roger Baker, Assistant Secretary for Information and Technology at the Department of Veterans Affairs.

We have Belinda Finn, Assistant Inspector General for Audits and Evaluations, Office of Inspector General for the Department of Veterans Affairs. Ms. Finn is accompanied today by Mario Carbone, Director of the Dallas Office of Audits and Evaluations.

We also have Ed Meagher, Vice President of Healthcare Strategy for the Computer Science Corporation.

We have Tom Munnecke, a former VA IT official.

Finally, we have Glen Tullman, Chief Executive Office of Allscripts.

I thank you all for being here this morning. Your testimony will appear in the record.

Mr. Baker, you are now recognized for 5 minutes.

STATEMENT OF ROGER W. BAKER, ASSISTANT SECRETARY FOR INFORMATION AND TECHNOLOGY, U.S. DEPARTMENT OF VETERANS AFFAIRS

Mr. BAKER. Well, thank you, Chairman Akaka, Ranking Member Burr, Members of the Committee. It is indeed a pleasure to appear in front of you again to discuss the state of VA's Office of Information and Technology.

Sixteen months ago the Members of this Committee confirmed me as President Obama's choice for Assistant Secretary for Information and Technology. At that time, you made it clear that you understood the significant challenges VA faces with information technology. I have appreciated your insights and your support over the last 16 months as we have worked to address those challenges.

As my written testimony goes into much more detail, we have aggressively dealt with the largest issues facing IT at VA. First, Senator Burr, as you noted, we introduced the Program Management Accountability System, which has already had a dramatic impact in transforming the results of our development organization.

Today, VA hits its system development milestones 80 percent of the time, a rate that nearly every CIO, public or private sector, would envy. We achieved this transformation by forcing projects to deliver functionality in small increments and communicating a schedule adherence in the organization. During 2010, we generated over $200 million of cost avoidance in our development organization by stopping or reforming poorly performing projects, money we have asked to reprogram to other uses to benefit veterans.

Second, in information security we have achieved our goal of having visibility to every desktop computer in the organization—as of yesterday, that is 310,722 of them—by September 30. What this means is that we can begin dealing with IT security holes in our infrastructure based on objective metrics and factual observations, not anecdotal incidents.

Third, we are now publishing metrics from across our operations organization to measure our operational excellence. At an enterprise level, our metrics show that our key systems are highly available. For example, our VistA systems across the country average 99.95 percent availability. We also know that customer support is a local experience so we are focused on measuring and publishing metrics on customer experience and customer satisfaction at an individual facility level.

Fourth, we once again have established for fiscal year 2011 a prioritized operating plan that will guide our decisions about where to invest our resources during the year. The intent of this is to give us clear visibility from plan to budget to spend to results, on every one of those more than $3 billion in our appropriation.

My written testimony also highlights several notable product delivery successes, deliveries that are tangible results of our disciplined approach to managing IT, including the new G.I. Bill Long Term Solution, Pharmacy Re-Engineering, and the Virtual Lifetime Electronic Record. These systems are already having an impact on the quality of care and the speed of benefits for our Nation's veterans.

While I am proud of the accomplishments of the VA IT organization over the last 16 months, I recognize that much more work remains to be done. As the only department-level consolidated IT organization in the Federal Government, I believe that VA IT must strive to be a leader both inside and outside of government. The Office of Information and Technology has made substantial strides forward and is well on its way toward achieving this goal. Indeed, in a number of areas, VA has blazed a trail of innovation that the rest of the government is beginning to follow.

Looking forward, we must use our new and disciplined management approaches to help us deliver improved IT systems that will have a direct impact on veterans, including the new Veterans Benefits Management System that will aid the Veterans Benefits Administration in achieving the Secretary's goal of "breaking the back of the backlog." We must deliver the Virtual Lifetime Electronic Records Initiative, ensuring that all providers of services to veterans have ready access to the information they need to provide quick and effective services.

We must deliver on the IT projects essential to the other 14 major initiatives, including ending veterans' homelessness and im-

proving access to care, that will promote the transformation of VA as envisioned by Secretary Shinseki. And we must create an open source model for the VistA Electronic Health Record System, bringing back the innovation that made VistA the best Electronic Health Record System in the country.

Mr. Chairman, while we have made significant improvements and had many successes over the last 16 months, as we look forward, I think it best to look back to the words of my confirmation testimony, and that is that there is no easy path, no simple answer, and no short-cut solution to creating a strong IT capability at VA. Achieving this will require hard work, disciplined management, and honest communications.

Thank you, Mr. Chairman, Ranking Member Burr, and Members of this Committee for your continued support of veterans, their families and their survivors, of the VA, and specifically of our efforts to transform VA IT. I am prepared to answer any questions you might have at this point. Thank you.

[The prepared statement of Mr. Baker follows:]

PREPARED STATEMENT OF ROGER W. BAKER, ASSISTANT SECRETARY FOR INFORMATION AND TECHNOLOGY, U.S. DEPARTMENT OF VETERANS AFFAIRS

Thank you Chairman Akaka, Ranking Member Burr, and Members of the Committee. It is indeed a pleasure to appear in front of you again to discuss the state of VA's Office of Information and Technology. My testimony will address the current status of the Department's major Information and Technology (IT) transformation initiatives as well as our future plans.

Sixteen months ago, the Members of this Committee confirmed me as President Obama's choice for Assistant Secretary of Information and Technology. During our pre-hearing discussions, you made it clear that you understood the significant challenges VA faced with information technology. I have appreciated your insights and support over the last 16 months to bring VA's technology into the 21st century.

Under this Administration, the Office of Information and Technology has made substantial strides forward, and is well on its way toward achieving the goal of being the best IT organization in the Federal Government, and comparable to many well-run private sector IT organizations. Indeed, in a number of areas VA has blazed a trail of innovation that the rest of government is beginning to follow. I would like to hit the high points of the last 16 months for you.

Customer Service:

The most dramatic change at VA has been in the relationship between OI&T and the Administrations (Veterans Health, Veterans Benefits, and National Cemeteries). With the Under Secretaries, and with the continuous support of Secretary Shinseki, we have set a tone of cooperation that has made it possible for us to effectively address many difficult problems at the second largest agency in the Federal Government. As an example, the successful delivery of the new GI Bill long-term processing solution, discussed in detail later in my testimony, was clearly an intense cooperative venture between OI&T and the Veterans Benefits Administration (VBA). Whenever asked by the Secretary about an issue or a success regarding the GI Bill, our team's answer consistently starts with "we." We built the system as a team, and we delivered the system as a team and that relationship is the single largest contributing factor to what is, for VA, a stunning victory and reversal of past practices—the successful installation of the GI Bill system on schedule in March of this year, and the complete conversion of all GI Bill processing to this system next August.

Thanks to Robert Petzel, M.D., Under Secretary for Health, Mr. Michael Walcoff, Acting Under Secretary for Benefits, and Mr. Steve Muro, Acting Under Secretary for Memorial Affairs, that same cooperative approach has spread throughout VA and continues to thrive. Together, we are ensuring that our staffs "get the message" that only by working together can we solve problems and not point fingers.

Program Management Accountability System:

In June of last year, after dealing with the failure of the Replacement Scheduling Application (RSA), this administration introduced the Program Management Ac-

countability System, or PMAS. Soon after, we stopped 45 ongoing and failing IT projects and, after analysis, canceled 12 and re-formed the other 33 to meet the strict requirements of PMAS. Our actions on those 45 projects generated $54 million in cost avoidance in 2010, allowing us to put those dollars to use on other critical investments to serve America's Veterans, their families and survivors. More importantly, we substantially decreased the risk of failure in the 33 projects that were re-planned and re-formed.

Under PMAS, all projects must deliver customer-facing functionality every 6 months (or less) without exception. This rapid delivery approach, with names such as Incremental or Agile development, is already used extensively throughout the private sector, where they cannot afford to waste millions on IT projects that never deliver. For VA, we combined rapid delivery with a management methodology that enforces strict adherence to project milestones.

The level of culture change accomplished within the VA IT development area over the last year simply cannot be understated. In March of this year, it became VA policy that all systems development projects would be managed under PMAS. Over 2,500 development staff, employees and contractors, now focus on making committed schedule dates as paramount, and break down all projects into deliverables that can be accomplished in less than 6 months. The measurable results are dramatic.

Last year, approximately 283 development projects at VA met their milestone dates an estimated 30 percent of the time. I say estimated because we have no real way of knowing, as IT development projects simply weren't tracked to their committed dates prior to PMAS. Today, VA has 97 active development projects, tracked in real-time through a project database and dashboard—they are meeting their milestone dates over 80 percent of the time. I know of no other Chief Information Officer (CIO), government or private sector, who has this level of insight into such a large portfolio of development projects. I can assure you, however, that most IT development organizations, public or private sector, would be ecstatic with meeting 80 percent of their committed milestones.

In 2010, VA had a cost avoidance of nearly $200 million by eliminating poorly performing projects and restructuring many others to lower risk, reduce spend rates, and incremental development plans.

Information Security:

As you are aware, the VA IT enterprise is massive, with 153 hospitals, 853 community-based outpatient clinics (CBOC), 57 benefits processing offices, and 131 cemeteries and 33 soldier's lots and monument sites on a single, consolidated network. Our mission requires that we hold Personally Identifiable Information and Personal Health Information on approximately 26 million Veterans, and that we make that information available quickly to health care providers and benefits personnel who need it to provide the most effective services to Veterans. Our network supports over 400,000 users, and over 700,000 devices.

To vastly improve our information security posture, this spring we embarked on a project to provide visibility to every desktop on the network by the end of the fiscal year. I am pleased to report that we achieved that goal, thanks to a lot of hard work on the part of many OI&T employees. By the end of the calendar year, we will also have achieved full implementation of our medical device isolation architecture, which is essential to mitigating security vulnerabilities in our medical devices. Finally, we will achieve full visibility to every device on our network during fiscal year 2011, putting us on par with the best managed private sector organizations. Our ability to provide immediate response to vulnerabilities and threats within our enterprise, as well as enacting a proactive approach to centralized monitoring, reporting, compliance validation and providing maximum service availability, is quickly establishing VA as a model of excellence for the rest of the Federal Government.

Operational Excellence:

I am proud to tell you that our operations organization provides excellent service to our hospitals, benefits offices, and cemeteries. I can tell you this because, starting in my first month at VA, we began to measure and publish key metrics that tell us how we are doing. We started at the core, measuring network availability (which averages 99.99 percent), Veterans Health Information Systems and Technology Architecture (VistA) system availability (99.95 percent), and help desk wait times. We have expanded these measurements to include a list of nearly 167 metrics covering aspects of our network, our service provision and our system/application provisioning that help us understand what works well and what does not.

Along our customer service theme, we are now focusing on providing metrics on how well we are doing at each individual VA facility. We will soon begin reporting key IT support metrics at each VA facility, allowing national operations staff to

work more easily and more quickly with the facility CIO and the facility director to identify and address issues that cause poor support. We also recently introduced a program to allow continuous monitoring of customer satisfaction at each facility, measured in a way that lets us compare customer satisfaction for our services versus those of similar private sector organizations. We intend to continue to augment the reporting of metrics and automate the collection of vital information thru the implementation of Enterprise Management Framework (EMF). The ability to measure these key processes and adjust accordingly is central to continuous operational improvement—a hallmark of a mature operation. Customer satisfaction is a local issue. In an enterprise the size of VA, it is not enough to focus on the averages. We must work to identify and address issues that affect local customer support and satisfaction, and to play our part in ensuring that each Veteran receives the best services possible.

Financial Management:

Finally, we created a detailed financial plan for OI&T in both 2010 and 2011, known as the Prioritized Operating Plan. This plan has two main purposes. First, it creates a vehicle for us to agree, with our customers, on what the high priority IT services and projects are, and allocate our resources to ensure success on the most important items. It also allows us to communicate, clearly and objectively, which projects and services will not be accomplished. Second, it allows us to track our expenditures, from plan to budget to spend to results, and know the business purpose for spending each dollar and then track the results we expect to obtain from the expenditure.

PROJECT DELIVERY HIGHLIGHTS

I would like to take a moment to talk about three projects that have been notable successes for VA IT over the last year.

New GI Bill Long Term Solution (LTS):

As I mentioned earlier, I'm pleased to report that VA has made tremendous strides in delivering Post-9/11 GI Bill benefits in a timely and accurate manner. We've also made significant progress in the development and deployment of our new processing and payment system. As a result of these significant strides, VBA recently reported that at the end of August last year, VA had processed payments for only 8,185 students for the fall 2009 semester. For the current fall term, VA has already processed payments for more than 135,000 students. The average time to process an enrollment certification in August 2010, was 10 days, down from 28 days one year ago.

We delivered and deployed Release 1.0 of the long-term solution (LTS) on schedule on March 31, 2010. In June and August 2010, we successfully deployed Releases 2.0 and 2.1 of the LTS. Release 2.0 allowed the complete processing of all new claims under the LTS, while Release 2.1 allowed the conversion of all previously processed records from the "Interim Solution" to the LTS. Through these deployments, we successfully converted over 500,000 Chapter 33 claimant records from our interim processing system into the LTS and are paying over 600,000 claimants from the LTS. We also added greater functionality to that originally planned for the LTS, adding functionality to include: enabling payment of retroactive housing allowance adjustments to those individuals eligible for the increased rates in 2010; automatically generating letters to individuals to provide them better information on their benefits; and facilitating claims processing for the Fry Scholarship recipients. VA is now processing all Post-9/11 GI Bill claims in this new system, thereby replacing the interim processing system and its associated manual job aides.

Most importantly, the new system was installed, and record conversion accomplished, with no significant errors. This meant that we were able to achieve our primary goal, which was to have the LTS installed in time to process fall semester claims without introducing processing errors or delays that might affect claims processing. The success of this roll-out is well above the industry norm.

While delivery of the LTS has been accomplished, functionality to automate interfaces to other systems has been delayed. The interfaces with the VA-ONCE system for certification of enrollment, and the benefits delivery payment system, previously scheduled for September 30, 2010, are now scheduled for October 30, 2010, and December 31, 2010, respectively. These delays are due primarily to the level of effort required to ensure that data conversion and basic allowance for housing (BAH) retroactive payment calculations were accomplished without introducing processing errors that would require manual correction and thus impact fall benefit processing.

Pharmacy Re-Engineering:

Pharmacy Re-Engineering (PRE) was one of the original 45 projects stopped in June 2009 under PMAS. At that time, PRE was a classic case of a VA IT project that had been unable to deliver functionality to customers over a period of many years. At the time it was stopped, PRE had just announced another one year slip in its delivery schedule, and management was not confident that no further slips would be encountered.

In October 2009, we re-formed and re-started the project under an incremental delivery project plan, with six increments originally defined. I am pleased to report that Pharmacy Re-Engineering is now in production in our Charleston, SC facility, and will soon move into beta test at additional facilities.

PRE Increment 1 (Foundational Enhancements) reached Initial Operating Capability (IOC) on October 23, 2009, a full 39 days ahead of schedule. This release provides tools to allow sites to begin setup required for Increments 3–4 and minor enhancements to the existing pharmacy system.

PRE Increment 2 (Pharmacy Enterprise Customization System) reached IOC as scheduled on March 5, 2010. This release provides tools to allow customization of commercial software system data used for medication order checking to better meet VA business practices.

PRE Increment 3 (Medication Order Check Healthcare Application—Non Dosing) reached IOC on June 29, 2010. This release was delivered 28 days beyond its planned due date because of delays in dependent projects and issues related to testing required before going live in a hospital environment. Enhanced order checks included in this release address a number of critical patient safety issues in legacy pharmacy applications.

PRE Increment 4 (Medication Order Check Healthcare Application—Dosing) reached IOC as scheduled on August 30, 2010. New maximum daily dose, daily dose range, and dosing guidelines provide clinicians with tools to reduce potential over- or under-dosing of prescribed medications.

When fully deployed, PRE increments 1–4 are expected to reduce accidental dosing errors (ADEs) by approximately 10 percent and will be used by approximately 10,000 pharmacy employees in the processing of 108 million outpatient prescriptions and 15 million inpatient orders annually. All of this will enhance the continued success of our Malcom Baldridge Award-winning VA Pharmacy system.

VLER

In April 2009, President Obama charged the Secretaries of Defense and Veterans Affairs with creating a Virtual Lifetime Electronic Record (VLER) to improve our ability to provide services to our Nation's Servicemembers, Veterans, their families and their beneficiaries. We have made substantial progress. Most visibly, we are now "live" in two pilots of the Nationwide Health Information Network in San Diego, CA and Hampton Roads in Norfolk, VA. This Nationwide Network is critical to VLER in that it will provide access to private sector records that are a large part of the lifetime of care received by Servicemembers and Veterans.

We have also implemented a consolidated eBenefits portal where Servicemembers and Veterans can access information on the benefits they are receiving or may be due. The eBenefits portal will eventually be the single point of entry for all benefits information. Perhaps most importantly, the eBenefits portal effectively bridges the conversion from active duty to Veteran status by allowing Servicemembers to retain the same login information they had as an active duty participant. This simple change is critical to the VLER concept.

Also critical to the VLER concept is the adoption by VA this summer of the Department of Defense's (DOD) Electronic Data Interchange—Personal Identifier, or EDI-PI, as the common identifier to be included in all VA records. This ensures that, once authenticated, both VA's and DOD's systems will have a shared, common way of identifying all records about a single individual. Thanks to outstanding DOD cooperation, we have also agreed that DOD will provide an EDI-PI for all individuals seen by VA, even if they were not known to DOD when the Veteran served.

Looking Forward:

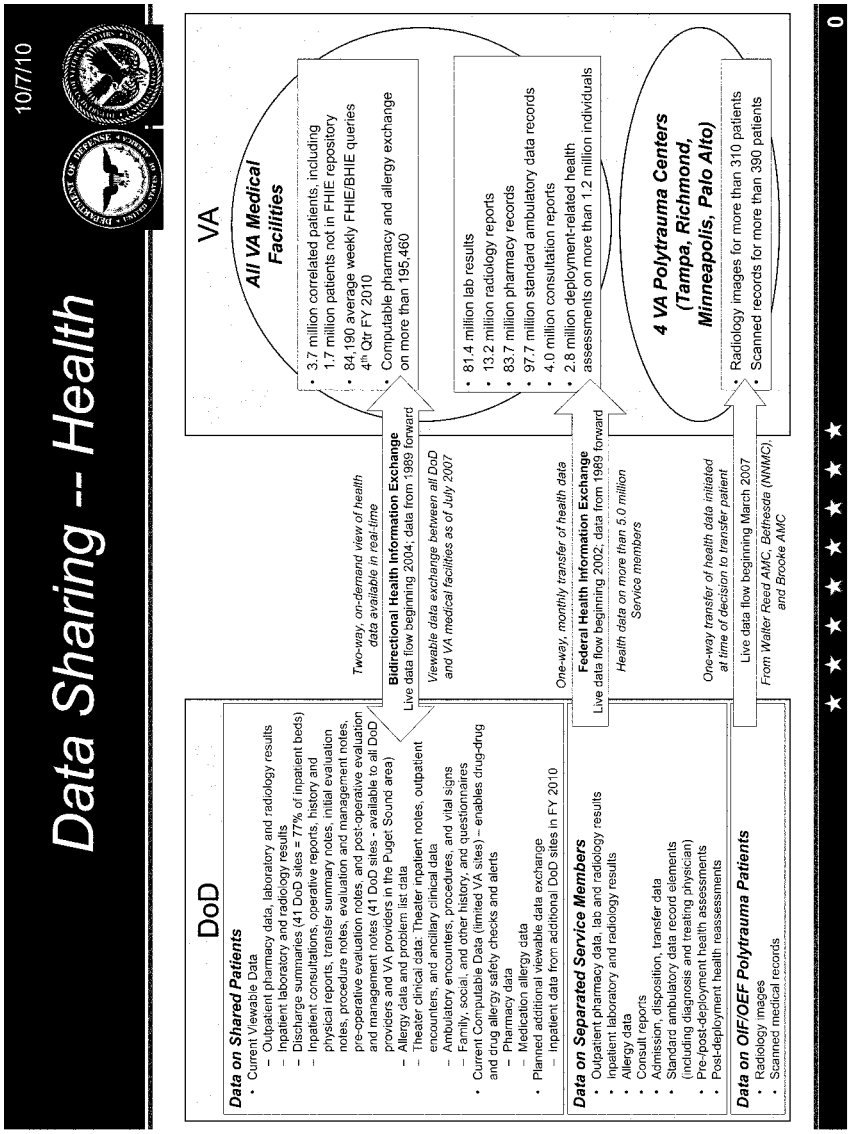
While I am proud of the accomplishments of the VA IT organization over the last 16 months, I also recognize that much, much more work remains to be done. As the only Department-level consolidated IT organization, I believe that VA IT must strive to be a leader both inside and outside of government. To that end, I would tell you what my goals are for us in the coming years:

1. Deliver effectively and efficiently the new Veterans Benefits Management System, aiding Veterans Benefits Administration in achieving the Secretary's goal of "breaking the back of the backlog."
2. Achieve the Virtual Lifetime Electronic Records initiative.
3. Deliver the IT projects essential to the other 14 major initiatives that will promote the transformation of VA as envisioned by Secretary Shinseki.
4. Create an Open Source model for the VistA electronic health record system, bringing back the innovation that made VistA the best electronic health record system in the country.
5. Solidify and refine PMAS to ensure that VA IT development projects continue to meet aggressive yet realistic customer delivery milestones.
6. Leverage the "visibility to the desktop" initiative to ensure compliance with critical information security policies throughout the enterprise.
7. Continue to ensure VA IT transparency by publicly publishing PMAS data, operational metrics, privacy breaches, and other management information of interest to the public.
8. Increase internal customer satisfaction with VA IT services by focusing on local support metrics and satisfaction.
9. Maintain the prioritized operating plan as the primary vehicle for communicating with our internal customers on budget decisions.
10. Continue to implement IT infrastructure improvements that increase our service levels and decrease cost.

CONCLUSION

Mr. Chairman, while we have made many significant improvements and had many successes over the last 16 months, we have only just begun down the path that we must follow to achieve our ultimate goal of a 21st Century VA. I think it best to reiterate the words from my confirmation testimony that are still quite true today: "There is no easy path, no simple answer, and no short-cut solution to creating a strong IT capability at VA. Achieving this will require hard work, disciplined management, and honest communications." Thank you Mr. Chairman, Ranking Member Burr, and Members of this Committee for your continued support: of Veterans, their families and survivors; of VA; and of our efforts to transform VA IT. I am prepared to answer any questions at this time.

ENCLOSURE



Chairman AKAKA. Thank you very much, Mr. Baker. Now, we will accept the testimony of Mr. Meagher.

STATEMENT OF EDWARD FRANCIS MEAGHER, CHAIRMAN, VISTA MODERNIZATION COMMITTEE OF THE AMERICAN COUNCIL FOR TECHNOLOGY INDUSTRY ADVISORY COUNCIL AND VICE PRESIDENT, HEALTHCARE STRATEGY, NORTH AMERICAN PUBLIC SECTOR, COMPUTER SCIENCES CORPORATION

Mr. MEAGHER. Aloha, Chairman Akaka, Ranking Member Burr, and Members of the Committee. I am honored to be here and I thank you for the opportunity to appear before you today to discuss the findings of the Industry Advisory Council's report, "VistA Modernization Report: Legacy to Leadership," and as you requested, to provide my views on current successes and failures in VA IT and recommendations for success in the future.

While discussing the VistA Modernization Report, I will be representing the Industry Advisory Council. However, while discussing any other issue, I will be representing myself only.

ACT-IAC is a unique nonprofit public-private partnership dedicated to advancing the business of government through the application of technology. The agenda is government-driven. ACT-IAC provides an ethical forum for collaboration where government and industry can create solutions for the most pressing government IT issues and challenges. That forum is objective and vendor and technology neutral. ACT-IAC also provides education and training to build essential knowledge and skills for government and industry professionals who want to serve the IT community. The greatest value of ACT-IAC is in its ability to deliver strategic insight and actionable solutions to advance government's ability to serve citizens and the Nation. Participation in the organization is open to any member of the government IT community who shares our commitment to advancing the business of government.

In September 2009, VA's Assistant Secretary Roger Baker asked IAC to assess the issues, challenges, and opportunities associated with modernizing the current legacy VistA system and make recommendations to address these issues and challenges to take advantage of the opportunities that are presented. At no expense to the government, IAC formed a committee of senior executives representing 42 of its over 500 member companies, and I was asked to chair this committee.

We began a process of first educating ourselves about the issues involved in modernizing a large, mission-critical legacy system and then specifically looking at the current state of VA's legacy VistA system. We looked at 24 alternative approaches to modernizing, and after narrowing those to six approaches, we examined those six in greater detail. In addition to the alternative subcommittee, we created subcommittees to explore and analyze options concerning architecture, implementation models, deployment models, governance, opportunities and impact, terms and definitions, and finally, reports and presentations. We estimate that over 7,000 man hours over a 6-month period went into the preparation and development of this report.

The committee operated on a consensus-based model, and we are all very proud of the fact that the final report was unanimously endorsed by all members of the committee. Our recommendations can be summarized as two high-level strategic recommendations and

seven specific actionable recommendations that describe programmatic next steps to implement our strategic recommendations. We believe we successfully negotiated the middle path such that our recommendations are not overly prescriptive nor are they just simply well intended generalizations. We believe we have recommended a sound, realistic approach that, while challenging, has a high probability of success and the potential to reaffirm VA's position as the preeminent leader in health information systems and electronic health records.

The two high-level strategic recommendations are: one, that VA commit to and announce a plan to move to an open source, open standards model for the reengineering of the next generation of VistA. This action should be a strategic policy for the VA. The working group recommended, second, that current VistA applications be placed on an aggressive program of stabilization with limited tactical upgrades and enhancements, driven only by patient safety and other mandated requirements.

If implemented, these recommendations will put the VA on a clear path to a future state where the next generation of VistA will be developed and deployed in a comprehensive state-of-the-art ecosystem that is more easily, robustly, and cost-effectively maintained; that allows for growth and change that encourages innovation; that promotes collaboration and interoperability; and most importantly, facilitates the delivery of the most advanced health care possible to the most deserving of populations, our Nation's veterans.

The working group then made four specific recommendations. So, based on their reputation for objectivity and sound judgment, the VA reached out to the federally Funded Research and Development Center community to rapidly tap into their skills and knowledge base resources to rapidly design and build a working model of the core ecosystem and to identify and validate the best model for the governance and business operation of this open source organization. Finally, FFRDC should be used to provide the functional decomposition of the current VistA application suite to deliver state-of-the-art functional specifications.

Finally, we made three additional recommendations as to how the VA should acquire the functionality in the new ecosystem and manage the transition between legacy VistA and the new open source-based VistA 2.0. I would ask that the Committee include the entire ACT-IAC VistA Modernization Report as part of my testimony.

[The report follows Mr. Meagher's prepared statement.]

Mr. MEAGHER. Now, speaking for myself exclusively as a former VA Acting Assistant Secretary, Acting CIO, Deputy Assistant Secretary, and also former Chief Technology Officer over a 6-year period, I would offer this personal assessment of the current VA IT environment. The centralization of all IT functions, funding, and personnel under the leadership of the CIO was and remains critical for the long-term success of IT at the VA. While a transition from decentralized to centralized management may have not gone smoothly, I believe that most of the issues have been addressed by Mr. Baker and his team. He has instituted a customer service orientation that puts the needs and requirements of the veteran and

the VA employee serving the veteran first and foremost. It is important to continue support for this centralized model.

Next, while there are literally dozens of high-priority IT requirements that need to be addressed, I believe it is critical that two of them be assigned the highest priority and that critical resources, funding, and focus be applied to them first and continuously. They are the modernization of VistA and the movement of the benefit claim processing to an all-digital fully computable system with the expeditious phasing out of paper-based records and a minimalization of the use of imaging of paper to only those situations where a digital computer representation is not possible. The successful prosecution of these two programs——

Chairman AKAKA. Mr. Meagher——

Mr. MEAGHER [continuing]. Will yield the greatest improvements.

Chairman AKAKA. Please summarize your statement.

Mr. MEAGHER. Yes, sir. I would like to ask that the rest of my comments be submitted for the record. Thank you, sir.

[The prepared statement of Mr. Meagher follows:]

PREPARED STATEMENT OF EDWARD FRANCIS MEAGHER, CHAIRMAN, VISTA MODERNIZATION, COMMITTEE OF THE AMERICAN COUNCIL FOR TECHNOLOGY INDUSTRY ADVISORY COUNCIL AND VICE PRESIDENT, HEALTHCARE STRATEGY CSC

Aloha Chairman Akaka, Ranking Member Burr, and Members of the Committee: I am honored to be here and I thank you for the opportunity to appear before you today to discuss the findings of the Industry Advisory Council's report, "VistA Modernization Report; Legacy to Leadership" and as you requested to provide my views on current successes and failures in VA-IT and recommendations for success in the future. While discussing the VistA Modernization Report I will be representing the Industry Advisory Council. However, while discussing any other issue I will be representing myself only. ACT-IAC is a unique non-profit, public-private partnership dedicated to advancing the business of government through the application of technology. The agenda is government driven. ACT-IAC provides an ethical forum for collaboration where government and industry can create solutions to the most pressing government IT issues and challenges. That forum is objective and vendor and technology neutral. ACT-IAC also provides education and training to build essential knowledge and skills for government and industry professionals who want to serve the IT community. The greatest value of ACT-IAC is in its ability to deliver strategic insight and actionable solutions to advance government's ability to serve citizens and the Nation. Participation in the organization is open to any member of the government IT community—government or private sector—who shares our commitment to advancing the business of government.

In September 2009, VA's Assistant Secretary for Information and Technology, Roger Baker asked IAC, "to assess the issues, challenges, and opportunities associated with modernizing the current legacy VistA system and make recommendations to address these issues and challenges and take advantage of the opportunities presented. IAC formed a committee of senior executives representing 42 of its over 500 member companies and I was asked to chair this Committee. We began a process of first educating ourselves about the issues involved in modernizing a large, mission critical legacy system and then specifically looking at the current state of VA's legacy VistA system. We looked at 24 alternative approaches to modernization and after narrowing those to 6 approaches we examined those 6 in greater detail. In addition to the alternatives subcommittee we created subcommittees to explore and analyze options concerning architecture, implementation models and extensions, deployment models, governance, opportunities and impacts, terms and definitions and finally reports and presentations. We estimate that over 7000 man hours over a six month period went into the preparation and development of this report. The Committee operated on a consensus based model and we are all very proud of the fact that the final report was unanimously endorsed by all Members of the Committee. Our recommendations can be summarized as two high level strategic recommendations and seven specific, actionable recommendations that describe programmatic next steps to implement our strategic recommendations. We believe we successfully negotiated a middle path such that our recommendations are not overly prescriptive nor are they well intended generalizations. We believe we have recommended a

sound, realistic approach that while challenging has a high probability of success and the potential to reaffirm the VA's position as the preeminent leader in health information systems and electronic health records.

The two high level strategic recommendations are:

1. The working group recommends that the VA commit to and announce a plan to move to an open source, open standards model for the reengineering of the next generation of VistA (VistA 2.0). This action should be a strategic policy for the VA.

2. The working group recommends that the current VistA application be placed on an aggressive program of stabilization, with limited tactical upgrades and enhancements driven only by patient safety and other mandated requirements

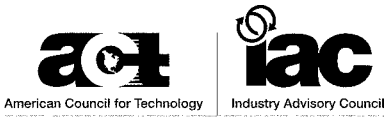
If implemented these recommendations would put the VA on a clear path to a future state where the next generation of VistA would be developed and deployed in a comprehensive, state-of-the-art ecosystem that is more easily, robustly, and cost effectively maintained; that allows for growth and change; that encourages innovation; that promotes collaboration and interoperability; and most importantly facilitates the delivery of the most advanced healthcare possible to the most deserving of populations, our nations veterans.

The working group then made four specific recommendations that the VA reach out to federally Funded Research and Development Centers (FFRDC) to tap into their skills and knowledge based resources to rapidly design and build a working model of the core ecosystem and to identify and validate the best model for the governance and business operation of the Open Source organization that will operate this ecosystem. Finally an FFRDC should be used to provide the functional decomposition of the current VistA Application Suite to deliver state-of-the-art:

- functional and design specifications of current application functionality
- functional and design specifications for required application functionality
- functional and design specifications for additional application functionality

Finally, we made three additional recommendations as to how the VA should acquire the functionality in the new ecosystem and manage the transition between legacy VistA and the new, Open source based VistA 2.0. I would ask that the Committee include the entire ACT-IAC Vista Modernization Report as part of my testimony.

Speaking for myself, as a former VA Acting Assistant Secretary and Acting CIO and Deputy Assistant Secretary and Deputy CIO as well as the VA's former Chief Technology Officer over a six year period I would offer this personal assessment of the current VA-IT environment. The centralization of all IT functions, funding, and personnel under the leadership of the CIO was and remains critical to the long term success of IT at the VA. And while the transition from decentralized to centralized management may not have been handled in the wisest, most thoughtful manner in the past I believe most of the oversights and the heavy handed approaches to operating within a centralized management model have been addressed by Assistant Secretary Baker and his team. He has instituted a customer service orientation that puts the needs and requirements of the veteran and the VA employee serving the veteran first and foremost. It is important to continue to support this centralized model. Next, while there are literally dozens of high priority IT requirements that need to be addressed I believe it is critical that two of them be assigned the highest priority and critical resources, funding, and focus be applied to them first and continuously. They are the modernization of VistA and the movement of all benefit claims processing to an all digital, fully computable system with the expeditious phasing out of paper based records and the minimalization of the use of the imaging of paper to only those situations where a digital, computable representation is not possible. The successful prosecution of these two programs will yield the greatest improvements to VA healthcare and benefits delivery that will allow the VA to deliver on Secretary Shinseki's promise to transform the VA into a 21st century organization. Finally, I believe there must be a practical, over arching vision established that describes how all of this comes together and the long discussed but not yet realized goal of "One VA" becomes a reality. This will require the setting aside of traditional boundaries between VA healthcare and benefits delivery, between VA and DOD, and ultimately between VA and all of the other public and private sector entities that provide or could provide our veterans with the best care possible. The modernization of VistA along the lines our report recommends and the commitment to finally build and operate an all digital, all computable benefits administration system are critical, essential steps to achieving what we all want, a veteran centric VA capable of delivering on our nations sacred commitment to "care for him who shall have borne the battle and for his widow and his orphan."



VistA Modernization Report

Legacy to Leadership

May 4, 2010

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Government and Industry IT: one vision, one community

American Council for Technology-Industry Advisory Council

The American Council for Technology (ACT) is a non-profit educational organization established in 1979 to assist government in acquiring and using information technology resources effectively. In 1989 ACT established the Industry Advisory Council (IAC) to bring industry and government executives together to collaborate on IT issues of interest to the government. In 1997 ACT established the Intergovernmental Advisory Board (IAB) to foster communication and collaboration between IT executives at all levels of federal service – Federal, state, local and tribal governments.

The American Council for Technology, in cooperation with the Industry Advisory Council and Intergovernmental Advisory Board, is a unique, public-private partnership dedicated to helping government use technology to serve the public. The purposes of the organization are to communicate, educate, inform and collaborate. ACT also works to promote the profession of public IT management. ACT and IAC offer a wide range of programs to accomplish these purposes.

ACT and IAC welcome the participation of all public and private organizations committed to improving the delivery of public services through the effective and efficient use of information technology. For membership and other information, visit the ACT-IAC website at **www.actgov.org**.

VistA Modernization Working Group

In response to a request from the U.S. Department of Veterans Affairs (VA), the Industry Advisory Council (IAC), chartered a working group on October 20, 2009 composed of experienced healthcare and information technology professionals selected from IAC member companies. Their charter was to respond to this request to assist the VA in understanding the issues associated with the modernization of its Veterans Information Systems and Technology Architecture (VistA) and make recommendations as to how the VA might proceed in modernizing VistA. The working group was composed of a single member from 42 member companies, representing the diversity of the government IT industry and was chaired by Ed Meagher, former Deputy Assistant Secretary for Information Technology, Department of Veterans Affairs. This working group was empanelled under operating principles and guidelines as established by the IAC Board of Directors and in accordance with the IAC Code of Conduct. Specifically and most importantly the individual members of the working group as well as the companies they work for agreed that:

- Government IT issues drive the agenda
- All activities will be ethical, open, and transparent
- All activities will be objective, fair and vendor/technology independent
- Lobbying and business development are prohibited

The working group took this to mean that they were not representing their companies while working on this project but were in fact professionally representing their industry and personally representing all veterans, citizens and other stakeholders. The working group conducted all of its deliberations under a consensus model and this report is presented on behalf of the entire membership of the working group.

Acknowledgements

The Working Group would like to acknowledge the dozens of individuals within the VA that spent many hours helping us understand VistA, as it exists today as well as the history and background of how it began and was developed over the years. We would like to thank the dozens of individuals and groups in private industry, the medical community as well as the Open Source community for their willingness to provide us guidance, instruction, and feedback as we built our understanding of the possible choices available. We would also like to thank the leadership and staff of the American Council for Technology and the Industry Advisory Council for the opportunity to participate in this important initiative, for their support during the process and for their trust that we would fulfill our responsibilities. There are too many individuals and organizations to list individually but to all who assisted us your contribution is known and acknowledged.

Disclaimer

This document has been prepared to provide information regarding a specific issue. This document does not – nor is it intended to – take a position on any specific course of action or proposal. This document does not – and is not intended to – endorse or recommend any specific technology, product, or vendor. The views expressed in this document do not necessarily represent the official views of the individuals and organizations that participated in its development. Every effort has been made to present accurate and reliable information in this report. However, ACT-IAC assumes no responsibility for consequences resulting from the use of the information herein.

Further Information

For further information, contact the American Council for Technology and Industry Advisory Council at (703) 208-4800 or www.actgov.org.

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VistA Modernization Working Group Charter

IAC was chartered by the Department of Veterans Affairs (VA) to assess the issues, challenges and opportunities associated with modernizing the current legacy VistA system and make recommendations to address these issues and challenges and take advantage of the opportunities presented. The group was specifically asked to respond to the following series of thematic questions:

1. Is VistA a system that could be deployed to a wider community? If yes, what is the most appropriate deployment model: open source code; cloud computing; business process/methodology; other?

2. If VistA is deployed and used by other government agencies or private sector entities, what organizational and management structure should be developed? Possible questions include:

    a. Which organization(s) should have responsibility for maintaining the system?
    b. Should VistA be established as a national standard? What are the implications of this action?

3. What is an appropriate strategy for modernizing VistA and transitioning it to a more current and innovative architecture? The strategy should result in an appropriate, creative and agile acquisition and development plan. (NOTE: The project will establish the general guidance and principles for this strategy and will not be involved in matters pertaining to any actual acquisition.)

4. What are the opportunities and impact of modernizing and deploying VistA upon private industry, the healthcare community and other key groups?

5. Based on the above, what principles and best practices should be documented and distributed for use by other government agencies considering similar issues?

As part of the assessment, IAC was asked to consider whether there are principles or strategies that would be applicable to other legacy systems currently operated by the government such as those driving Social Security and Medicare.

VistA Modernization Background

VistA has been developed and managed by the VA over the last 25 years and is used throughout the VA's 153 Medical Centers and 768 VA Outpatient Clinics across the country serving almost eight million veterans. In addition, the US Indian Health Service and commercial and public hospital systems in several states and foreign countries have adopted versions of VistA.

VistA is generally recognized as the most completely integrated healthcare information system in existence(Longman, 2007). VistA currently provides each veteran a completely digital medical record that has improved quality, patient safety, patient and provider satisfaction and lowered costs and may have value for the entire national healthcare community. However, as one of the government's oldest legacy information technology systems, VistA must be updated and modernized in order for the VA to continue to meet the needs of the veteran community and to enable the private sector to take advantage of the breadth of healthcare applications included under the mantle of VistA.

VistA Modernization Working Group Approach

The VistA modernization working group decided to divide its available time into three roughly equal segments. The first segment was devoted to informing and educating ourselves as a group. The entire working group met at least weekly to receive briefings and ask questions of VA and private sector experts. The working group collected and analyzed hundreds of available documents, reports, and studies. The entire working group made a field trip to the Washington, D.C. Veterans Administration Medical Center and received an in depth set of presentations by senior hospital administrators and VistA managers and working staff. The working group was allowed to view VistA in operation in a clinical setting and speak to clinicians, developers, and support staff. At the conclusion of this period the entire VistA working group participated in an all-day, off-site working session to review what had been learned and plan the next phases.

The second segment was devoted to analyzing the information and knowledge the working group had assembled and to decide what additional information and analysis was required. It was decided to divide the whole working group into several subcommittees to focus on identified issues that needed more study and analysis. These subcommittees consisted of:

- Executive Committee

- Subcommittee on Alternatives
  - The Alternatives subcommittee was asked to look across the various subcommittees and identify alternative approaches, analyze those alternatives, and ensure that all viable alternative approaches were adequately considered and analyzed.

- Subcommittee on Modernization and Architecture
  - The Modernization and Architecture subcommittee was asked to identify and analyze the modernization and architectural approach associated with the overall working group's recommendation. Areas of consideration included open source techniques to leverage innovation within and outside of the traditional OI&T environment. These included clinicians, large and small public health information technology organizations such as Military Health and the Indian Health Service, as well as large commercial health informatics systems providers. Additionally, the group included open source developers associated with World VistA as well as two motivated developers in a garage who want to get involved in or help advance healthcare IT – respectively.

- Subcommittee on Models and Extensions
  - The Models and Extensions subcommittee was asked to understand the assessments of the working groups and to apply these to the real world environment at the VA.

- Subcommittee on Deployment Models
  - The Deployment Models subcommittee was asked to explore the various options for deploying a large scale, complex system and identify the pros and cons associated with each approach.

- Subcommittee on Governance
  - The Governance Models subcommittee was asked to identify and rationalize the various approaches to

governance for the recommended deployment models. In addition, the Governance Models Subcommittee was charged with identification of open source licensing alternatives and recommendations.

- Subcommittee on Opportunities and Impacts
  - The Opportunities and Impacts subcommittee was asked to examine, analyze and recommend areas of opportunity for transacting distinct innovation within health Information Technology (HIT), Electronic Health Records (EHR's) and other healthcare delivery processes and identify their high-potential impacts or results of modernizing and deploying VistA within the public-private sector healthcare communities, markets and other key groups.

- Subcommittee on Terms and Definitions
  - The Terms and Definitions subcommittee was asked to develop a complete set of relevant terms and clear definitions that will ensure that the entire working group shares a common understanding of the issues under discussion.

- Subcommittee on Reports and Presentations
  - The Reports and Presentations subcommittee was asked to assisting the other subcommittees in the preparation and presentation of their reports so that they are clear and consistent. Additionally, they were responsible for version control of drafts and the development of the final report and presentation produced by the VistA Working Group.

During this period more focused briefings and discussions were held to clarify the working group's thinking and to begin the process of coming to conclusions about the working group's recommendations. The various subcommittees and the entire committee met at least weekly. The working group conducted a second all-day off-site working session where a high level narrative of the working group's findings was presented and discussed. After several rounds of revisions and amendments, the working group endorsed the approach and directed the subcommittees to focus on this set of recommendations.

The third segment was devoted to the task of answering the questions that were posed by the VA, creating a set of recommendations, and drafting the final report. A great deal of time and effort was expended to ensure that the recommendations and the report were consensus-based and represented the best advice the information technology community could provide.

VistA Modernization Working Group Executive Summary

The Industry Advisory Council (IAC) of the American Council for Technology (ACT) was asked by the Department of Veterans Affairs (VA) to form a working group representing a broad cross section of the Information Technology (IT) community that supports the Federal government. The VA asked IAC to provide answers to several specific questions and to provide specific recommendations to the Department that represents the IT Community's best advice on how to modernize VA's legacy health information system, the Veterans Information Systems and Technology Architecture (VistA).

In response, the Industry Advisory Council (IAC) chartered a working group on October 20, 2009 composed of 42 experienced healthcare and information technology professionals selected from among the 540 IAC member companies. The working group was comprised of experienced IT professionals from small to very large companies with backgrounds in technical disciplines, management, healthcare and marketing.

The working group agreed to represent their industry and not their companies and to provide their guidance and advice as citizens and IT professionals. The group met at least weekly and held 3 all day off site sessions. The group conducted research on the issues by interviewing and questioning dozens of experts within the VA and spoke with an equal number of industry and subject matter experts. The working group adopted a consensus based decision-making model and delivered the following recommendations **unanimously.**

- The working group recommends that the VA commit to and announce a plan to move to an open source, open standards model for the reengineering of the next generation of VistA (VistA 2.0). This action should be a strategic policy for the VA.

- The working group recommends that the current VistA application be placed on an aggressive program of stabilization, with limited tactical upgrades and enhancements driven only by patient safety and other mandated requirements

- The working group recommends that the VA contract with an appropriate Federally Funded Research and Development Center (FFRDC) to provide a detailed set of technical specifications for the development of a VistA 2.0 Open Source Core Ecosystem (Figure 1). Use of the term ecosystem by the working group refers to "the entirety of hardware, software, and networks that drives the delivery of VistA 2.0 products and services."These technical specifications should describe the following components

    - Open Source, Open Standards Operating environment

    - Open Source, Open Standards Application Development Environment

    - Sand Box Application Development Environment and based on the following set of high level characteristics to ensure that this ecosystem is optimized for

        - High performance,
        - Security and identity management
        - Scalability

  This operating environment must provide a scalable, segmented, open source, open standards environment that will provide the following components

    - Operating environment
    - Security services
    - Identity management
    - Database functions
    - Application programming interfaces
    - Data structures and terminology
    - Rules development and enforcement
    - Test and certification environment

  This ecosystem must also natively support

- A structured open source application development environment that will provide the following common services
  - Trusted and approved application development tools, datasets, test cases, and test, simulation and certification services
- A "sand box" application development environment that will provide the following common services
  - Application development datasets, test cases, test, and simulation services

- The working group recommends that the VA contract with an appropriate FFRDC to build and deliver a fully functioning prototype based on the technical specifications developed by the initial FFRDC for the Open Source Core Ecosystem consisting of the
  - Open Source, Open Standards Operating environment
  - Open Source, Open Standards Application Development Environment
  - Sand Box Application Development Environment
- The working group recommends that the VA contract with an appropriate FFRDC to provide an appropriate business model, bylaws, operating principles and organizational blueprint for an independent, not-for-profit Open Source Foundation to manage, operate and maintain the VistA 2.0 Open Source Core Ecosystem, based on the recommendations provided by the Governance subcommittee in this report
- The working group recommends that based on the recommendations provided by the FFRDC tasked with providing an appropriate business model, bylaws, operating principles and organizational blueprint for an independent, not-for-profit Open Source Foundation that the VA charter and initially fund an independent, not-for-profit, Open Source

foundation to manage, operate and maintain the VistA 2.0 Open Source, Open standards Core Ecosystem, Open Source Application Development Environment, and Sand Box Application Development Environment

- The working group recommends that the VA contract with an appropriate FFRDC to provide the functional decomposition of the current VistA Application Suite to deliver a state of the art
    - set of functional and design specifications of current application functionality
    - set of functional and design specifications for required application functionality
    - set of functional and design specifications for additional application functionality
- The working group recommends that the VA determine what application functionality it wants to develop/acquire for the VistA 2.0 Open Source Core Ecosystem using
    - internal in-house application development resources
    - external commercial application development resources
    - Commercially available (i.e., commercial-off-the-shelf [COTS]) products
    - Open source application development resources
- The working group recommends that the VA develop a master schedule for the acquisition of these applications and functional capabilities
- The working group recommends that the VA develop and acquire the applications and capabilities based on the VistA 2.0 Open Source, Open Standards Ecosystem that meet its requirements and develop a plan and schedule for concurrent operations and migration from VistA to VistA 2.0

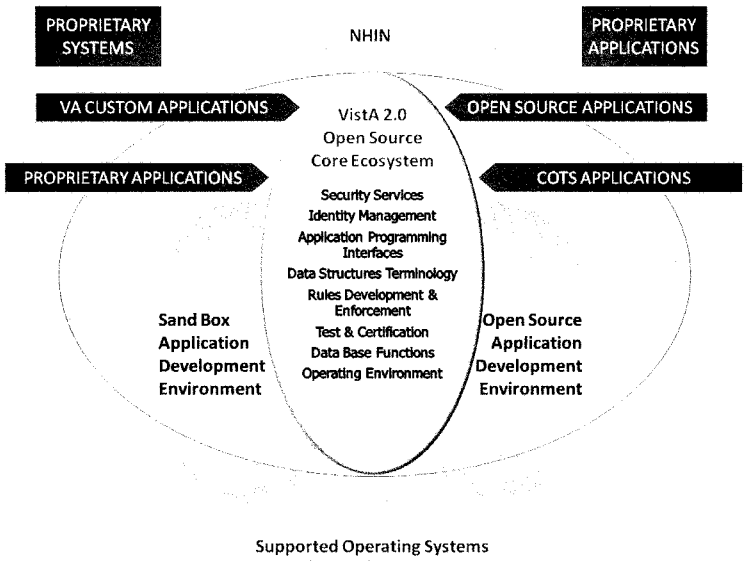

Figure 1: VistA 2.0 "Egg" Diagram

VistA Modernization Working Group Responses to Specific Questions Posed

One of the objectives of this project was to provide VA with an industry-based, community-wide response to a set of specific questions. The working group provides the following short responses to each question posed. More detailed responses are provided in the working group's recommendations and the information provided in the subcommittee recommendations.

Is VistA a system that could be deployed to a wider community? If

yes, what is the most appropriate deployment model: open source code; cloud computing; business process/methodology; other?[1]

VistA is currently deployed to a small community of public, private and international users outside of the VA. However, because it is very difficult to operate and expensive to modify it has not had a much wider adoption. We recommend that VistA be used as a functional specification and be completely reengineered within the VistA 2.0 Open-source, Open-standards Ecosystem as recommended by this working group so that a much wider community can adopt and extend it more readily.

If VistA is deployed and used by other government agencies or private sector entities, what organizational and management structure should be developed? Possible questions include:

Which organization(s) should have responsibility for maintaining the system?

We recommend that VA "sponsor an open-source community" to promote the continued development and extension of VistA 2.0 functionality and associated business rules.

Should VistA be established as a national standard? What are the implications of this action?

Given the resources that VA has expended to date and can bring to bear in the future on this issue, VistA 2.0 should be offered up as the international standard information system for medical centers. Not only would this result in huge financial savings in the healthcare community, but VistA 2.0 would provide huge advances in evidence based medicine, medical research and data standardization and portability.

What is an appropriate strategy for modernizing VistA and transitioning it to a more current and innovative architecture?
The strategy should result in an appropriate, creative and agile acquisition and development plan. (NOTE: The project will establish the general guidance and principles for this strategy and will not be involved in matters pertaining to any actual acquisition.)

VistA should not be "modernized" in the sense of upgrading and updating current VistA in a traditional evolutionary model. VistA should be "reengineered" into VistA 2.0 in the sense of creating a new, open-source, open standards ecosystem within which the proven functional capabilities of VistA can be replicated, modernized and enhanced in a sustainable, scalable, and secure environment.

What are the opportunities and impact of modernizing and deploying VistA upon private industry, the healthcare community and other key groups?

The national and international healthcare communities desperately want and need an appropriate, consistent and dependable "guide-star" architecture, development environment, and reusable components within a fair, open, and collaborative community. While this report focuses on solving VA's challenges, we feel obligated to at least mention that this system has larger Federal, national and even international implications.

Based on the above, what principles and best practices should be documented and distributed for use by other government agencies considering similar issues?

The lessons learned from the efforts of the VistA Modernization Project are applicable and appropriate for other government agencies facing similar issues. Many older, large-scale government legacy software systems are serving adequately at the current time but are in need of modernization and/or re-engineering. This working group has developed a series of processes and principles that have been documented and can be directly applied to other Departments and Agencies of the Federal Government.

VistA Modernization Working Group Recommendations

The working group recommends a "reengineering approach" to the modernization of current VistA where reengineering encompasses the following understandings.

Replicate (screen by screen; interface by interface if reasonable) the functionality of the existing VistA (legacy) system using:

- contemporary technology and agile development processes
- modern open systems architecture
- reusable components and/or COTS components and applications

Harvest everything of value from current state VistA, including:

- Data models
- Business processes
- Test cases
- Workflows
- Performance metrics
- User or even system level documentation
- Training materials

Have as a first order goal the replication of current, acceptable VistA capability and refrain from adding new functionality until the legacy system has been decommissioned, but plan for new functionality as VistA 2.0 is being designed and architected.

Assume that every line of code in the reengineered VistA 2.0 system will be replaced with many fewer lines of much more maintainable and malleable code that can last a few decades but be upgraded, modified, and enhanced easily.

The reengineering of the legacy VistA system recommended in this report should **not** be confused with the reengineering of the business processes of an organization!

The Working Group Recommendations

- The working group recommends that the VA commit to and

announce as a matter of strategic policy a plan to move to an open source, open standards model for the reengineering of the next generation of VistA (Vista 2.0) to include the core ecosystem as well as those components built by the VA, for the VA, or by the open source community.

- Current VistA should be placed on an aggressive program of stabilization with limited tactical upgrades and enhancements driven by patient safety and other mandated requirements

- The working group recommends that the VA contract with an appropriate Federally Funded Research and Development Center (FFRDC) to provide a detailed set of technical specifications for the development of a VistA 2.0 Open Source Core Ecosystem (Figure 1). Use of the term ecosystem by the working group refers to "the entirety of hardware, software, and networks that drives the delivery of VistA 2.0 products and services." These technical specifications should describe the following components

    - Open Source, Open Standards Operating environment
    - Open Source, Open Standards Application Development Environment
    - Sand Box Application Development Environment

  and based on the following set of high level characteristics to ensure that this ecosystem is optimized for

    - High performance,
    - Security and identity management
    - Scalability

  This ecosystem must provide a scalable, segmented, open source, open standards environment that will provide the following

    - Operating environment
    - Security services

- Identity management
- Database functions
- Application programming interfaces
- Data structures and terminology
- Latencies or service levels associated with capability or service invocation
- Rules development and enforcement
- Test and certification environment

This operating environment must also natively support

- A structured open source application development environment that will provide the following
  - Trusted and approved application development tools, data definitions with sample de-identified datasets, test cases, and test harnesses for simulation and possible self certification or at a minimum unit test
- A "sand box" application development environment that will provide the following
  - Application development datasets, test cases, test, and simulation services

- The working group recommends that the VA contract with an appropriate FFRDC to build and deliver a fully functioning prototype based on the technical specifications developed by the initial FFRDC for the Open Source Core Ecosystem consisting of the
  - Open Source, Open Standards Operating environment
  - Open Source, Open Standards Application

Development Environment

- Sand Box Application Development Environment

- The working group recommends that the VA establish effective governance for the VistA 2.0 Open Source Core Ecosystem as quickly as possible. This governance should be based on the recommendations provided by the FFRDC tasked with providing an appropriate business model, bylaws, operating principles and organizational blueprint for an independent, not-for-profit Open Source Foundation. The working group recommends that the VA charter and initially fund an independent, not-for-profit, Open Source foundation to manage, operate and maintain the VistA 2.0. The three most feasible approaches to establishing Governance for the VistA 2.0 platform, and the open source applications that will be written to operate on it, are

  - Establish a new entity to carry out the governance of VistA 2.0

  - Select an existing open source organization with existing charters, license agreements, and operational procedures, that would adopt the principles provided by the recommending FFRDC and provide an immediate starting point for VistA 2.0 governance

  - Have an FFRDC provide governance directly based on the principles provided by the recommending FFRDC

- The working group recommends that the VA contract with an appropriate FFRDC to provide the functional decomposition of the current VistA Application Suite to deliver a state of the art

  - set of functional and design specifications of current application functionality

  - set of functional and design specifications for required application functionality

  - set of functional and design specifications for additional application functionality

- The working group recommends that the VA determine what application functionality it wants to develop/acquire for the VistA 2.0 Open Source Core Ecosystem using
    - internal in-house application development resources
    - external commercial application development resources
    - Commercially available (COTS) products
    - Open source application development resources
- The working group recommends that the VA develop a master schedule for the acquisition of these applications and functional capabilities
- The working group recommends that the VA develop and acquire the applications and capabilities based on the VistA 2.0 Open Source, Open Standards Ecosystem that meet its requirements and develop a plan and schedule for concurrent operations and migration from VistA to VistA 2.0

Alternatives- Executive Summary

The Alternatives subcommittee was asked to "think outside the box" and make sure that the working group had thought through all the reasonable alternatives for radically improving VistA within VA. Twenty alternatives were suggested and analyzed by the alternatives subcommittee and then by the entire working group. Six of these alternatives were considered to be the most practical. With further discussion and anlaysis, the subcommittee concluded that each of these 6 alternatives could be categorized as being either:

- Improve and restructure what already exists or
- Reengineer VistA in order to completely replace the current system.

The subcommittee recommends the reengineering approach be undertaken by harvesting as much useful functionality, business rules, screen designs, and data models from VistA as possible.

Assumptions

VA has access to adequate resources to fund any reasonable alternative.

VA needs are given priority by this working group as compared to other stakeholders such as DoD, commercial healthcare, etc. Solving VA's problem is large enough challenge, we have not attempted to consider all the issues related to IHS, DoD, DoS, HHS, or commercial interests. However, the desirability of leveraging VA resources and investments to support the U.S. national agenda to implement electronic health records was a consideration.

The VA does not need to build the best electronic medical record system in the world. However, it must operate the best one.

We assume that the current VistA system cannot survive as is indefinitely. Not only will it become increasingly obsolete in comparison to alternatives, but its current architecture and design cannot safely support significant changes and upgrades.

When it was first built, VistA was ahead of its time. It enabled the VA to move from being the worst to the best large-scale healthcare provider in the U.S. However, since its implementation, the U.S. commercial healthcare market has made significant strides to bring functional tools to the market. Meanwhile, the pace of change and innovation in VistA has slowed significantly, partially due to deliberate cessation of enhancements while VistA's intended replacement system (HealtheVet) was under development. Commercial products are beginning to outstrip VistA in functionality, capability, and reliability. In addition, the number of people who understand how to maintain and enhance the current VistA application is dwindling. Therefore, a solution should be implemented and deployed in the next 5 years.

Analysis Process

The Alternatives subcommittee began with an extended brainstorming session to identify as many different approaches to solving the problem of how to get to a replacement system. This list of about 16 alternatives was then shared with the entire working group which resulted in four more entries on the list.
The list of 20 alternatives along with a short description of each is provided below:

	Alternative	Description
1	X Prize	Launch a giant challenge to industry with an associated giant prize to the winner; e.g., $100m to the first company that can replicate the functionality of several key VistA applications or some such carefully considered and measurable challenge
2	Angel Ventures	Provide relatively small amounts of money ($100's of thousands) to entrepreneurs to see if they can spawn new companies replicating important chunks of the VistA functionality
3	Big Bake Off	Launch a competition with a relatively small number of entrants (<10) which is pared down to two or three rather quickly until a single winner is announced -- not unlike what DoD does when acquiring new aircraft
4	Big Bang Modernization	Have a competition to select a single team to "modernize VistA" using traditional requirements, design, and development methods
5	Oregon Experiment	Replicate the process used to improve the University of Oregon infrastructure; it involved dividing the budget into three categories (mega, medium size, and tiny) each of which was asked to replicate successful "patterns" that seem to have worked well there in the past
6	Buy COTS	Accept the fact that COTS vendors are not producing products that will satisfy most of VA needs; So buy the best and build only the rest
7	Cope and Hope	This was the title given by a senior VA leader to the current development process; so this is a business as usual approach
8	Adopt AHLTA	DoD has been much more successful in getting a set of vendors to build functionality in a hurry; so why not just adopt what DoD has done and move out from there…
9	ARPA	The Advanced Research Projects Agency (now DARPA -- Defense) has been successful in DoD for more than 40 years doing very leading edge research -- sometimes with considerable pay-offs; sometimes not
10	FFRDC	Create a Federal Funded Research and Development Center (FFRDC) to foster the research, design and development of new functionality for VA
11	Structured Open Source	Discover or create a mechanism to much more aggressively participate and even lead the open source community in the development of innovative new systems and applications

12	Manhattan Project	In four years, the Federal government managed to assemble a massive team of 130,000 scientists, engineers, construction workers, and military experts to design, develop, test, and deploy radically new "technology". Can or should a similar approach be taken with VistA?
13	NSF/NIH	National Science Foundation/National Institute of Health: these agencies fund fundamental research -- some of which is already related to healthcare IT; maybe we should just radically increase their budgets and see what happens
14	Stock Market for Ideas	Maybe we should look for completely new ways to get a lot more well informed, deeply involved users and innovators involved in this process; one such idea is to create a "stock market for new ideas" where a large collection of people (say 1,000) are each issued 1 million dollars to invest in new ideas by buying and selling "idea stocks"; the result is a near instantaneous quantifiable list of new ideas that might be funded
15	Skunk Works	The Air Force has had considerable success in the design and development of radically new aircraft by simply giving the task to a small, select team of very well funded experts working in "relative seclusion" -- sometimes "total seclusion"
16	Stumble Forward	Make small changes to what we already have and reduce expenditures
17	Healthcare IT Extension Service	Maybe there is a way to create geographically dispersed research centers co-located with universities doing related work in Healthcare IT
18	"Toucan"	There is considerable precedent in the software industry to suggest that really big innovations or breakthroughs come from two person teams -- one of whom is highly technical; the other understands the needs of the users and is likely one him or herself. Since many of the VistA applications were actually built this way, why not do what has proven to work in the past
19	Reengineer VistA	Use VistA as a functional specification and replicate its external functionality using the latest available and appropriate technologies -- quite different from a modernization project which tries to do everything that people want, but have never managed to build before
20	Evolutionary Modernization	Maybe it is possible to modernize "chunks of VistA" without trying to take on the whole system; how these large independently designed and developed chunks might fit together is to be determined

Table1 – List of Alternatives Considered by Working Group

Observations and The working group then took these 20 alternatives and did a variety

Outcomes

of evaluations which included:

- Extent of Research
- Financial Risk
- Technical Risk
- Governance Complexity
- Number of Partners Involved
- Annual Costs
- Degree of Control
- Source of Funding
- Time to See Benefit
- Estimated Return on Investment

From these 20 alternatives, 6 were deemed most practical, valuable, and viable. Those six were:

- Structured Open Source
- Two Can (aka Toucan)
- Stumble Forward
- Reengineer VistA
- Big Bake Off
- Buy COTS

As we analyzed these six alternatives we noticed that they boiled down to the two basic options described below:

(1) Restructure the existing VistA system, piece by piece, into a more modular and well-behaved application while still using it. ("Changing the tires while the car is still on the road.") and

(2) Build a replacement system reusing the business processes, workflow, screen designs, and data models from VistA. This reengineered system must be done using a contemporary architecture which is more structured and properly componentized (with components being provided from internal VA development, external development by paid contractors, project grants, the open source community, or commercial off-the-shelf products).

Both options carry a significant level of risk. The working group recommends the second option because it will provide a sufficiently malleable base upon which much needed enhancements and

improvements can be made over the next few decades. But the subcommittee recognizes that many involved will consider the first option to be a faster and safer approach in spite of ten years of data to the contrary. Reengineering projects, unlike modernization projects, have a very high success rate, even for large legacy reengineering projects.

Transition to any new system will require operating both VistA and the new system in parallel for a period of time. Planning for this transition must begin on day one and is recognized to be one of the largest challenges in designing and developing a reengineered system.

Therefore, the current VistA should be replaced with a new system that supports interoperable "plug-and-play" of increasingly advanced system components and modules, putting it on a new foundation that supports future evolutionary enhancements. This conclusion seems relatively straightforward and generated little controversy within the broader working group. However, the more difficult question is what is the appropriate path to take to reach that objective.

While not chartered to propose such a path, the subcommittee had detailed discussions regarding various approaches. We were convinced that when an appropriate architecture, a sufficient set of development tools, and enough open source components become available many individuals, small companies, large companies, and other organizations will be keenly interested in contributing software, time, and effort to completing the reengineering effort.

Recommendation of the Subcommittee on Alternatives

A Vision for 2020.The current VistA should be replaced with a new system that supports interoperable "plug-and-play" of increasingly advanced system components and modules, putting it on a new foundation that supports future evolutionary enhancements. By having a combination of contracted software components, open source components, and COTS software will give the VA maximum flexibility to choose the best of breed. The result will be a state of the art, medical application development environment with a comprehensive suite of extensible components and functional applications provided by VA, entrepreneurs, university researchers, commercial medical and non-medical software products companies, national health services, etc. with a superset of the functionality in today's VistA system.

How might we get there?

To get there, we believe VA must reengineer VistA, then extend and expand it as required with the support of a new open source ecosystem launched by VA, to augment its existing acquisition approaches of internal development, contracted development, and COTS acquisition.Evaluation of the sources for potential alternatives would be based upon functionality, extensibility, security, quality, etc.

The ecosystem's goals should be two fold. In the short-term it should drive the architectural and reengineering efforts of the existing system, while progressing towards a day when it becomes the 'upstream' provider of software to the VA.

We recommend replacing all the code in VistA while retaining the required functionality (business processes, workflow, information on screens, data model, etc.). The most important aspect of the new system is the development of an architecture which includes identification of well-behaved ways for the modules to communicate with one another. It should be redesigned, reengineered, reimplemented, appropriately documented, fully tested, and progressively deployed. It should also support local VA configuration, while still retaining a single code base which is managed under strict configuration control.

Modernization and Architecture- Executive Summary

The Modernization and Architecture Subcommittee first investigated the historical successes and less than fruitful approaches to modernizing VistA or adding enhanced capabilities to the VistA environment. Based on informal question and answer sessions with those involved in sustaining, enhancing and evolving the current VistA environment, the subcommittee explored the possibilities and potential for continued incrementally evolution of the environment through improved interface definition, data definitions and service level definition (logical modularization). This approach was discussed with the entire working group at length and the working group as a whole decided that the reengineering of current state VistA to an open source, open architecture environment, dubbed VistA 2.0, was the desired and optimal path. To achieve this target state, the development of a reference model is required consisting of the following:

- Core Services derived from an analysis of the capabilities of the VistA kernel and the requirements of future state VistA 2.0

- A documented Open Source Architecture (similar to logical modularization, includes interface definitions and data definitions with required response times or service levels)

- An Open Source Software Development Kit (SDK) including a recollection of accepted open source development tools and some limited number of exemplar medical applications outside of the core of Vista 2.0 to show developers acceptable approaches on how to invoke capabilities of the core from outside of the core.

- Standardized data model

- Standardized interfaces

- Use of open source tools

The reference model, consisting of the core with sample applications outside of the core, should be built on and for a modular, scalable hardware platform which should be optimized for performance, security and identity management, and scalability. The notional high level representation of the reference model is depicted below in figure 2. The exact approach is left up to the developing body – the Federally Funded Research & Development Center (FFRDC) as detailed in the sections on Governance and Deployment.

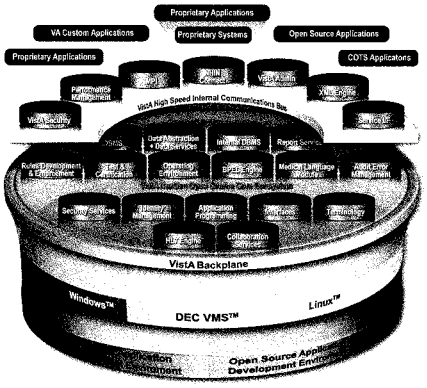

Figure 2 – High-Level reference model representation

As the core of VistA 2.0 is developed, VistA, as it exists today, should be prepared to coexist with Vista 2.0 as the capabilities become available by aggressively moving towards stabilization – freezing the current capabilities while only addressing patient safety issues and defining the logical interfaces, data definitions and services levels associated with the application environment allowing for logically invoked functions on a modular level via the use of an application broker. This parallel path enables the ultimate release of open source capabilities in an open architecture is depicted in figure 3 below and allows for a seamless transition to the user community

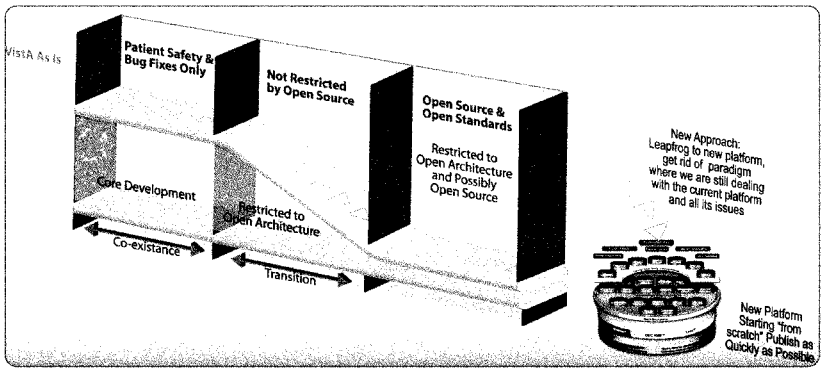

Figure 3 -- The Path to VistA 2.0

Assumptions

- "Innovation" and "Open source" are the main drivers for VistA modernization. Other important drivers are the lack of consistent architecture, inflexibility of the current system, maintenance costs, performance issues, security issues, scalability and availability issues.
- Restated as individual assumptions:
  - For clinical reasons, VA needs to increase the rate of innovation in VistA
  - The current VistA architecture greatly increases the total cost of ownership
  - Current maintenance costs, while not necessarily onerous to the VA, could be better utilized to provide new innovation and functionality
  - Availability and scalability of current VistA needs improvement
- VA is looking for a VistA 2.0 system that facilitates innovation.
- An Open Source environment is a strategic goal of the VA

- Development activities for Vista 2.0 must be accomplished in synchrony with stabilization and limited patient safety related enhancements to current VistA
- It is acceptable to develop a new system from scratch as long as the core business processes are preserved
- VA will support the base "standard" VistA 2.0 core ecosystem and accept/certify software from other implementers as long as it is developed in the VistA 2.0 ecosystem and tests and certifies in that environment.
- The target state vision for VistA 2.0 modernization and its proposed architecture is a long term strategy
- The use of COTS products together with Open source products (wherever applicable) is acceptable as long as the COTS products align with the VA EA framework and adhere to the common interfaces specified within core VistA 2.0
- The recommendations should take into consideration all development communities including VA, open source communities and other commercial vendors.

Analysis Process

The Modernization and Architecture Subcommittee adopted industry best practice analysis techniques and processes to address the complex task of VistA modernization. The process consisted of:

- Gaining an understanding of the existing VistA environment
- Gathering information on gaps and issues
- Determining modernization goals
- Developing architecture principles and guidelines to aid decision making
- Evaluating options
- Developing recommendations.

Information was gathered from a variety of sources and perspectives. The team conducted interviews and had working sessions with sources, within the VA, as well as external sources:

- Clinical User perspectives (VA DC Medical Center staff)
- Architect perspectives (Legacy Architecture)

- Engineer perspectives (Interagency Sharing)
- VA OI&T Management (Office of the Assistant Secretary)
- OED (Legacy Product Services)
- FOIA VistA implementers.

The Current State

From the Clinical User perspective, "VistA, as currently implemented at the Department of Veterans Affairs, is the most comprehensive, large scale, integrated healthcare information system in the world. It successfully supports more of the specific functional requirements of its extensive user base than any other large scale system."

Yet from the IT perspective, we find a different perspective that includes words like *brittle, complex maintenance, complex operations, complex deployment, code that is not well structured, difficult to test, difficult to integrate, and inability to support current and emerging technologies.* The IT perspective is validated by the organization's inability to deliver substantial new functionality for the last few years.

Gaps and Issues

During each interview/meeting, the team identified known/perceived gaps and issues. The gaps and issues are summarized in Table 2:

Gaps and Issues	Perspective	Impacts
New functionality takes too long to deliver.	Clinical User	Product Delivery
Integration of new technologies takes too long.	Clinical User	Product Delivery Innovation
VistA perceived as brittle – it breaks it does not bend.	Clinical User	Performance
COTS does not integrate well with VistA.	Clinical User	Product Delivery
Roll and Scroll users less happy than CPRS users.	Clinical User	Usability
Easy to get data in, hard to get data out.	Clinical User Engineer	Performance Innovation
Semantic interoperability among multiple VistA implementations.	Clinical User Architect	Usability

Gaps and Issues	Perspective	Impacts
Heterogeneous technology mix makes maintenance, installation and operations difficult.	Engineer Operations	Product Delivery Innovation
Product complexity and unstructured code.	Engineer Architect	Product Delivery Innovation
Dated technologies impact innovation and maintenance and operations.	Engineer Architect Operations	Product Delivery Innovation
Local ability to customize impacts stability	Engineer Architect	Product Delivery

Table 2 – Gaps and Issues Identified by Subcommittee on Modernization and Architecture

Modernization Goals

With the assistance of the various stakeholders, the team created a set of goals for the modernization of VistA (not prioritized).

- Enhance "innovation" and improve the flexibility of the system so that new features/functions can be delivered in a timely manner
- Improve the ability to incorporate enhancements and performance of the product
- Increase the ease and rate of technology and functional innovation
- Make the data more accessible for reporting and analysis
- Maintain clinician end user involvement in requirements identification, application design and user acceptance
- Reduce the costs associated with operations and sustainment

As is seen in both the gaps and the goals, there are multiple, often competing, concepts. Recognizing this, the team developed a number of architectural principles to guide decision making for modernization.

Recommendations Subcommittee on Modernization and Architecture	The subcommittee recommends the development of a reference model based on open source technologies with a documented open architecture for VistA 2.0 which should include: • Core Services derived from an analysis of the capabilities of the VistA kernel and the requirements of future state VistA 2.0 • A documented Open Source Architecture (similar to logical modularization, includes interface definitions and data definitions with required response times or service levels) • An Open Source Software Development Kit (SDK) including a recollection of accepted open source development tools and some limited number of exemplar medical applications outside of the core of Vista 2.0 to show developers acceptable approaches on how to invoke capabilities of the core from outside of the core. • Standardized data model • Standardized interfaces • Use of open source tools
Models and Extensions- Executive Summary	The mission of the Models and Extensions Subcommittee was to understand the recommendations of our colleagues and their respective teams, yet make sure the outcome could achieve what the VA is trying to accomplish.
Assumptions	Aligned with the mission, we used the assumptions made by the working group and the other subcommittees.
Analysis Process	The Models and Extensions subcommittee met weekly to discuss the draft recommendations document. Several members of this team sat in on the other team's weekly meetings, to keep current on the processes and recommendations that were being formulated. This team attended all of the off-sites, also to understand the VA's perspective on this project. Research was done to understand the current state of affairs at the VA, how to implement change in an organization of this size, and some of the real life experience from

the team members was also brought into play. Several of the team members have assisted in implementations around VA and its facilities in the past.

Observations and Outcomes

The VA has numerous challenges ahead. We agree with the recommendations of the various subcommittees and believe we have also given them some ideas on how to have the recommendations succeed in an Open Source, fluid and complex environment. We believe one of the biggest challenges the VA will have around the Vista Project will be a culture change in the overall way they procure software, incent the Open Source communities to participate, and speed development of this mission critical application and infrastructure. We hope that the Executive Level stakeholders at the VA will embrace the ideas and recommendations that these subcommittees have put forth.

Recommendation of the Subcommittee on Models and Extensions

The Models and Extensions subcommittee approached this task by understanding what we were modeling would reflect the real world of an enterprise wide, mission critical application. This would include all aspects from the software development to the cultural changes that could come about. Our recommendations attempt to reflect real users and business concerns.

Cultural Barriers, Innovation Risks

Timing

The VistA Working Group has decided on a recommendation of the establishment of an Open Source Foundation (OSF) dedicated to the development of VistA 2.0. The timing of the OSF implementation is of significance. The OSF must make available components of ***value*** to the community, including the VA as soon as possible. The VA must contribute viable, working core code as the foundation of the VistA 2.0 OSF. This foundation code will be a key event that will show the members and potential members of the community that the Open Source venue is meeting its goals and will be establishing a community in which they will want to participate. At the same time, the VA stakeholder's expectations for meaningful and productive enhancement and improvements to current VistA applications must be met with timely availability of value as soon as possible after establishment of the OSF. The design of the OSF will take the needs for early delivery into account in order to maximize participation and probability of success.

Community

The concept of OSF in Government is not new. Several currently exist with a variety of missions expressed in their founding charters and various degrees of vitality. One measure of the success of OSF's is the robustness of their "ecosystem". There are potentially disparate driving interests of community members that culminate in a single thriving Open Source community.

In this case, we define the ecosystem as the contributing members of the foundation. Each member of the foundation will have significant motivation for participation – typically each member in equal standing. In the case of the VistA OSF recommendation, we have assessed several areas of interest that stand to make the VistA OSF ecosystem a vibrant community. There are several unique drivers that stand to contribute to this end.

The single biggest driver will be the development funding provided by the VA. The process of a Government agency providing funding for a non-profit OSF organization is not new. One practiced means of providing this application development funding is through a grants program. Another alternative may be a direct funded RFP process where foundation members compete for the opportunity to develop modules, applications, or components. Both processes involve a fair and equitable decision making process of soliciting, evaluating and committing funds for each particular piece.

With many modules, applications and components needed, these requirements, over time will be many and varied and will be plenty to keep vigorous community attention. Potential interested members of the community include companies in the medical software applications market, smaller entrepreneurial businesses, university research teams, and pure software and systems development companies.

A second motivator of the OSF community is access to the code itself, the OSF's intellectual property. Each member of the OSF is entitled to the OSF VistA products subject to the terms of the license agreement. The terms of the license agreement are as established in the OSF charter. The specific license terms are to be determined with the setup and establishment of the OSF and as recommended by the FFRDC given that mission. There will be many OSF members, whether they actually develop code or not, that will be

keenly interested in securing the VistA core and application software. Typically, the companies in this market will be involved in a variety of businesses including that of Value Added Resellers that might supplement, combine services and package derivative products for sale. The viability of this market has already been established.

A third motivator of the community is the availability of VA's test data. With the appropriate redactions for privacy &security, and protection and separation of the development environment by the OSF, there is significant research value in the VA's data. Various researchers throughout the country have already shown keen interest in the rich and voluminous information collected by the VA for many years. The potential to learn from the unique nature of VA's long-term relationship with its patients is remarkable.

Innovation

There are several elements of the Open Source recommendation that foster real innovation. The Sandbox development environment can provide the means for innovative members of the OSF community to brainstorm and prototype a wide variety of potential capability without constraint. The Sandbox innovation can be fueled by incentive programs sponsored by the OSF or VA that would involve compensation for the best and brightest solutions. A second method that has the potential to foster significant innovation involves a process for cultivating third-party development of ***plug-in*** applications. This method mirrors the Google apps approach, where based on published standards, API's and in this case perhaps Sandbox availability, third-parties develop their own mini-applications that can then be sold in a marketplace. This marketplace may be VA or it may be the commercial medical software and systems markets – perhaps even directly to the veterans themselves.

Culture

Are there significant cultural barriers? Anytime changes are made in an organization, there are impacts to Agency culture. At the point that these changes become a barrier, the momentum moving forward with strategic change may be slowed. The concept of VA being an active and responsible member of and OSF community, participating in governance, operations, funding, testing and fielding applications that come from and OSF source all reflect new operating procedures. These processes will not be an abrupt step transition, but will be a more gradual ramp to establish and implement efficient and effective operation in this new environment. The VA personnel are not new to their overarching mission. With a careful picture drawn of the advantages of the OSF development to the larger community including VA and hospitals outside of the VA,

states and municipalities, foreign countries, and other stakeholders, they will see the significance of their investment moving forward. The foundational culture of caring for VA patients, and now perhaps patients within a larger community, will not change.

Business Model – Developing New Applications

Grants, contract awards, innovation prizes and even donations from member companies make up the wide variety of mechanisms within an Open Source construct that can generate valuable application code, modules and useful development or production utilities. Success is what drives each of these areas. There is a win-win perspective for each of these cases and in an active development community, the opportunities for success and the resulting successes are clearly visible. A diverse economic model with multiple mechanisms to drive innovation and development will yield the greatest results for all participants.

Open Source

The Open Source Community is alive and well. President Obama's commitment to this mode of development resonates in his goal for Open and Transparent Government. There are numerous commercial companies embracing this concept, as they develop new products and tools to work within an OS environment. Web 2.0 creation is also a key component. People in everyday life are used to applications that are interactive, visual and easy to navigate. This has created an expectation that the business applications used must follow the same guidelines. This has created a drive for the development communities to share their creations, develop new and innovative applications, and assist all with the overall view of sharing information. Dashboards, report cards, scorecards, etc. are all very prevalent in Federal agencies today.

The challenge that the VA may have is how to harness this innovative community to create specific applications around patient centric care. This draft addresses some ideas to have this community participate in the VA programs.

VistA & VistA 2.0

- The current recommendation is that VistA and VistA 2.0 run in parallel for a period of time. This will require an investment in 2 areas-
    - first to keep the current system up and running under an aggressive program of stabilization with limited tactical upgrades and enhancements driven by patient safety and other mandated requirements

- substantial investment in developing the VistA 2.0.

As there is a wealth of discoveries around new medical applications and processes, and this information must find its way to the VA. The VA must commit to being open to researching and understanding what might be available in the commercial world, while maintaining the highest level of care and ensuring patient safety.

Before VistA 2.0 can be successful, the VA must involve the current VA community as stakeholders in the success of VistA 2.0. This may require a cultural shift and it is imperative that the stakeholders view themselves as agents of change, while not sacrificing their day to day commitments.

Process to bring in New Applications

The current paradigm of VistA software development must evolve into a structured application development approach that is defined by strict governance and change management. Well-defined processes will need to be developed for bringing new applications into the structured Open Source application development environment. A governing body must be ready to enforce rules and guidelines as they are established and set timelines for releases, upgrades, and maintenance tasks. Testing and certification entities must be established and engaged to maintain quality control. The Sandbox, though "unstructured" in nature, will need to be maintained by a dedicated entity. The key to success will be in maintaining a healthy application development process, utilizing tools such as social media to drive innovation and motivation.

Program Control and Oversight

The importance of program control and oversight in the Open Source application development environment cannot be overstated. The pros and cons of both internal and external governing bodies will need to be weighed carefully. Who will have the ultimate control over the Open Source application development environment? A well-defined approval process will be an integral part of the overall application development strategy and must be applied consistently across development organizations of all sizes.

The security and privacy of personal health information is a common thread across all electronic health record (her) systems, in both the public and private healthcare sectors. Who will address security needs across systems and applications in the VistA 2.0 environment? This will be one of the first challenges faced by

stakeholders of the new VistA ecosystem.

Risk, Threats and Barriers

The introduction of a VistA Open Source ecosystem into the current EHR marketplace may pose a threat to clinicians and vendors already carving a niche in this space. It is fair to assume that many stakeholders outside of the VA would not welcome this new marketplace competitor, as it may have economic implications. For example, physicians and hospitals in rural communities with limited resources would likely choose a robust Open Source EHR solution as opposed to a costly proprietary system.

Other risks to the VA may include: 1) the financial commitment required to modernize VistA and 2) the time commitment required to develop VistA 2.0 on a modern platform.

The mitigation of these risks will be a crucial component of the successful evolution of VistA 2.0.

Deployment Models - Executive Summary

The Deployment Models subcommittee considered several key aspects in an effort to identify the best suited and optimal approach for the deploying VistA 2.0 within the VA and external organizations. These aspects included –

- Logical and Physical Deployment models
- Systems Development Life-Cycle related Deployment Activities
- Deployment Pillars - Integrated System Characteristics such as Reliability/Availability, Maintainability/Support, Scalability, Extensibility and Interoperability
- Deployment Environments – An Innovation Sandbox including computing environments/reference models for development, test, integration, release and production

Given the size and complexity of the Department of Veterans Affairs and its implications for the VistA 2.0 system based on an open-source approach and architecture, it is imperative that deployment activities be built around five pillars - ***Reliability/Availability, Maintainability/Support, Scalability, Extensibility and Interoperability***. The foundational model to best support these pillars is accomplished most efficiently through a Centralized Model for logical deployment of applications. It is recommended that the ***Centralized model*** be enabled by the appropriate physical model based on cloud computing and service orientation. Regardless of the

system architecture and governance framework, a VistA 2.0 system based on an open architecture and open-source software will be capable of being deployed via a variety of Logical and Physical models.

In addition to the deployment model, the choice of a ***Systems Development Life-Cycle (SDLC)*** is critical to successfully implement and deploy VistA 2.0, based on an open architecture. While there are several traditional SDLC methodologies to choose from, large and complex organizations like the VA often define and customize their own version(s) of the SDLC methodology to best meet their needs. A flexible approach to the SDLC such as Agile methodologies in the VA environment would potentially be the most successful with the appropriate governance framework put into place.

It is recommended that ***open-source based Development, Test, Integration and Release environments*** be established to foster Class III type innovation from organizations external to the VA. To ensure a successful deployment and sustainment of the VistA 2.0 solution careful considerations should be provided to the development of a comprehensive Deployment Roadmap with a well-defined end result, Disaster Recovery and Continuity of Operations Planning (COOP) capabilities required, and the FOIA and Patch release processes for delivery and deployment of VistA 2.0 software in an open-source environment.

Assumptions

- Changes to deployment or redeployment of the current VistA environment (Cache) is outside the scope of the subcommittee's considerations.
- Deployment considerations related to various business models that may be utilized to provide VistA to a wider audience are outside the scope of the subcommittee's recommendations.
- Deployment models best suited to meet the VA's mission may not match the deployment needs (dictated by technical and/or business constraints) of organizations external to the VA.

Analysis Process

In addition to participating in the weekly working group calls, the Deployment Models subcommittee actively engaged in

	brainstorming activities and discussions with other subcommittees including Models and Architecture, Governance, and Opportunities and Impacts. Given the downstream nature of the deployment activities within the systems lifecycle, such participation provided the opportunity to learn and share key insights with these groups and ensure a coherent overall approach and recommendations. The following deployment related aspects were analyzed and considered in light of the proposed open-source approach to VistA 2.0– ▸ Logical and Physical Deployment models ▸ Deployment Activities – SDLC-related ▸ Deployment Pillars - Integrated System Characteristics ▸ Deployment Environments – Innovation Sandbox
Observations and Outcomes	▸ Regardless of the Models or Architecture selected, VistA 2.0 will be capable of being deployed via a variety of Logical and Physical models. ▸ No loss of current capability to deploy in a variety of physical and logical models
Recommendation of the Subcommittee on Deployment Models	▸ It is recommended that VistA 2.0 be deployed using a Centralized logical model enabled by the appropriate XaaS model for the VA or another organization adopting the open-source VistA software. ▸ Deploy VistA 2.0 using physical and logical model which best suits specific mission need ▸ Establish Open Source Application Development, Test, and Evaluation environment ▸ Create an Innovation Sandbox for External to VA contribution and enhance Class III type innovation within the open-source ecosystem ▸ Provide careful considerations to the following for a successful deployment of a modernized VistA solution:

- Developing a comprehensive Deployment Roadmap with a well-defined end result.
- Disaster Recovery and Continuity of Operations Planning (COOP) capabilities required.
- FOIA and Patch release processes for delivery and deployment of VistA 2.0 software in an open-source environment.

Governance- Executive Summary

Credible and effective governance is just as important to the success of the VistA 2.0 platform as the technology decisions that will be made.

The working group recommends that the VAcontract with an appropriate FFRDC to establish or identify an external entity to provide governance for the VistA 2.0 platform and for the applications that it makes available as open source.
The working group recommends that the VA establish Governance as quickly as possible after VA makes a commitment to an open source approach.

The working group recommends that the VA work with the governing entity to identify (from existing licenses) those licenses which will help create and maintain a vibrant "eco-system" of open source and proprietary applications built around the VistA 2.0 platform

Assumptions

- VA will make a highly visible public commitment to an Open Source approach to the VistA 2.0. VA will include a timeline for initial activities to demonstrate commitment and create urgency.
- VA will create or sponsor a VistA 2.0 platform version 1.0 and an associated tool set, and make it available as open source.
- VA will publish Application Programming Interface specifications, which will allow development of medical applications for use of VA.
- VA will develop (internally or by contract) a significant set of critical VistA applications to run on the VistA 2.0 platform, and make those applications available as open source. VA will have

to provide functional specifications and performance requirements to ensure these applications meet its needs.

- Any applications internally developed by VA, or custom developed by VA, will be made available as open source.

Analysis Process

In order to meet this objective, the Subcommittee gathered information on the current VistA system and Open Source alternatives through research of publicly available books and articles; interviews with industry experts, including Mr. Mike Milinkovich from the Eclipse Foundation and Skip McGaughey from Open Health Tools. The Subcommittee also conducted specific research on various license types currently in use in the open source community. Governance Subcommittee members participated in all ACT-IAC VistA Working Group current systems analysis, demonstrations, and knowledge sharing sessions, as well as other subcommittee meetings and proceedings (Modernization & Architecture, Deployment Models, and Executive Subcommittees). The team met weekly to review progress and status and next steps.

Observations and Outcomes

Why would VA make the VistA 2.0 platform and a suite of applications associated available as open source? There are two primary two reasons. First, the VA would derive benefits including cost savings and infusion of innovation from the open source community. The VA will be sharing the cost of software debugging, maintenance and improvement with a community of users. As the number of users increases, so does the number of institutions and individuals who are invested in improving the software. Furthermore, it is reasonable to assume others will develop innovative ideas and applications on the VistA 2.0 platform, which VA can consider using. In current VA terminology, "Class III" software can be developed outside VA as well as inside VA. Secondly, a widely used VistA 2.0 platform offers potential benefits to the entire healthcare industry. It would greatly enable interoperability, which would benefit individual patients and the healthcare industry. Applications written on the VistA 2.0 platform, and certified as adhering to its standards and definitions, will be inherently interoperable, or could be made interoperable with a minimum of effort. Additionally, a viable VistA 2.0 platform available as open source, along with a significant suite of applications, both open source and proprietary, could hasten adoption of electronic health records across the country.

Establishing Governance

If VA is to make the VistA 2.0 platform available as open source, along with a compelling set of development tools, frameworks and a significant suite of applications, it must consider how this software will be governed.

Why does open source software need governance? Governance ensures that the software is distributed and maintained in accordance with the licensing for the software. Effective governance ensures that the product is maintained and improved to meet the needs of the user community. Effective governance keeps the software from "splitting" -- that is it prevents the development of competing and incompatible versions of the same software. Maintaining a "gold standard" version of open source software benefits the entire user community by increasing operational efficiency and effectiveness, accelerating the rate of improvement, and reducing operational costs.

What are the attributes of effective governance? Effective governance brings together all major users and stakeholders, and meets their collective needs. No one user benefits at the expense of other users. A governing body or entity would

a. Establish a well defined set of membership and governance processes, essentially a set of rules and procedures that stakeholders agree to. This assures that all stakeholders play by the same rules and are following the same processes, helps avoid conflict, and provides processes for dealing with the conflict when it inevitably occurs.

b. Bring together and enlarge the stakeholder community. Establish a neutral and effective forum for discussion and work to benefit the entire community, built upon trust and effective communication.

c. Establish a set of rules, processes, and practices that are part of the software development and improvement process. This assures that for clinical applications, "life critical quality characteristics" are followed and are replicable.

d. Maintain the reference model or "Gold Standard" version of the VistA 2.0 platform and open source software

written against it. Help the community decide what suggested improvements or changes are adopted, and help resolve technical issues. Distribute and license the software.

e. Create and maintain a vibrant ecosystem centered on VistA 2.0. This would help with aftermarket products and services (education, training, partner programs etc.) as well as deployment offerings to assist with implementations.

f. Create and maintain a development environment, regression test environment, and a self certification environment for applications for the VistA 2.0 platform.

Governance should be established as quickly as possible. The working group recommends that the VA establish governance for the VistA 2.0 platform as quickly as possible. Governance is necessary for the community to come together, and the governing body will help assemble the community. VA will need to balance four essential attributes around establishing governance. They are:

- Speed - speed at which effective governance can be established
- Effectiveness – degree to which the governing body can meet the requirements of effective governance described above
- Credibility – that is, acceptance of the governing body by internal and external stakeholders
- Influence– the degree to which the VA can maintain necessary and appropriate influence and guidance over the VistA 2.0 platform

Speed. VA will want to ensure that effective governance is established as quickly as possible. Many issues will arise as soon as VA begins to develop the VistA 2.0 platform. The governing body should be working from the beginning to attract stakeholders, help resolve issues and establish its approach to the wide range of governance issues and functions.

Effectiveness. Governance must be effective for an open source strategy to be successful. Membership rules, governance processes and software standards must all be in place and seen as fair, reasonable, even handed and designed to promote the interests of the entire community.

Credibility. The governing body must be seen as highly credible by potential and actual stakeholders. Reputation, previous work, existing membership and projects, and stature of its leadership are all key issues. Credibility does not necessarily come easily or quickly. Slowly building credibility over time would not be the preferred approach.

Influence. VA will have a fundamental interest in ensuring that the VistA 2.0 platform, as it is developed and maintained, is always highly useable by and acceptable to the VA. As envisioned, VA will have a robust suite of mission critical applications working on top of this platform. VA will want to ensure that it is always using a version of the platform compatible with the open source version. If the platform VA uses ever diverges or "splits" from the open source platform, the benefits of open source will be lost to VA. Therefore, VA will have to be assured that the governing body always sees VA as a major stakeholder, and that as decisions are made, VA's interests will always be protected, consistent with the interests of the broader open source community.

How will the VA Establish Governance?

As indicated above, VA must establish effective governance as quickly as possible. How will VA do this? The three most feasible approaches to establishing Governance for the VistA 2.0 platform, and the open source applications that will be written to operate on it, are

- Establish a new entity to carry out governance, based on the business model, bylaws, operating principles and organizational blueprint for an independent, not-for-profit Open Source Foundation as provided by the recommending FFRDC

- Select an existing open source organization with existing charters, license agreements, and operational procedures, that are in concert with the business model, bylaws, operating principles and organizational blueprint for an

independent, not-for-profit Open Source Foundation as provided by the recommending FFRDC which would provide an immediate starting point for VistA 2.0 governance

- Have an FFRDC provide governance directly in concert with the business model, bylaws, operating principles and organizational blueprint for an independent, not-for-profit Open Source Foundation as provided by the recommending FFRDC

VA will need to carefully weigh the approach it takes to establishing effective governance. **Credible and effective governance is just as important to the success of the VistA 2.0 platform as the technology decisions that will be made. Therefore, the approach taken toward establishing governance should be given thesame level of consideration, to help ensure the highest probability of success.** Each of the three approaches has pros and cons, which are discussed below.

Establish new entity to carry out governance. VA could establish a new entity to govern open source VistA 2.0, possibly with help from an FFRDC to accomplish this very quickly. While an organization could be established quickly, two issues would need to be addressed. One, could the organization establish effective and credible leadership, working capital and a reasonable business plan, all necessary to ensure long term viability? Two, would a new organization have sufficient credibility to attract stakeholders? The stature and experience of the leadership of the new organization would be critical.

Select an existing organization. Another approach would be to select an existing organization to provide governance. One would look for an existing organization that is currently providing governance to open source software, knows the existing community of VistA stakeholders, would be seen as credible by the stakeholder community, and would be able to attract additional stakeholders. This could be done through an existing membership or through an acquisition process.

Direct FFRDC governance. VA could task an FFRDC with providing governance over open source VistA 2.0. FFRDC's are generally not-for profit, operate in the public interest, and provide objective and independent advice and action. An FFRDC could in theory provide credible and effective governance for open source

VistA 2.0. The question would be whether the FFRDC would know the stakeholder community, could attract additional stakeholders into the community, and would be seen as fair, credible and sufficiently independent from VA to govern in the interests of the wider community.

Membership. If VA is a member of an organization that governs open source software, and sees that organization as a viable candidate to govern open source VistA 2.0, it could simply designate that organization as the governing organization. This has the benefit both of speed, and ensuring VA at the end of the day has the governing body it thinks will be most effective.

Acquisition. Another approach would be to follow an acquisition process. That is, VA would issue a RFP and invite organizations to offer proposals. VA would select from the proposals submitted, based on experience governing open source software, current membership and business model, ability to attract a broader community of stakeholders, the financial and other resources offered, and the cost of the services being offered. This approach would offer all interested parties the ability to compete for designation as the governing body, and might therefore be seen as "fair" by those interested parties. VA might also encourage them to consider partnering. However, this approach has some potentially serious drawbacks. Some highly viable governing entities might determine that they cannot participate in an RFP-type process. Therefore, effective and definitive market research would have to be undertaken before this approach could be considered. Furthermore, one could question whether this approach could be sufficiently rapid to meet VA's needs, and whether VA would end up with a desired outcome at the end of the process. Once undertaken, an acquisition approach could well be very difficult to abandon, and so should be pursued only if VA is convinced it will be quick enough to meet VA's needs, and will yield an effective outcome.

No matter what approach is taken, The working group recommends that the VA be aware that one or more existing organizations or entities might well see themselves as ideally suited to provide the governance VA is looking for. If these entities are not chosen, they are likely to question both the decision made, and the process VA followed to achieve the decision. No matter what approach is taken, VA must be prepared to articulate sound reasons for the approach taken, and why at the end of the day it creates or chooses one

particular governing body.

VA Role in Governance

If VA is to derive the expected benefits from placing the VistA 2.0 platform and associated applications into the open source community, VA will need to take a highly visible and active role in the activities of the governance entity – that is, in the ongoing improvement of the VistA 2.0 platform, and in the ongoing maintenance development of any open source applications running on the VistA 2.0 platform. By actively participating, the VA will ensure that improvements to the platform and applications are made on an ongoing basis. VA's active involvement and support will demonstrate its commitment to the platform and to the open source business model. This will encourage additional users, which will in turn stimulate additional applications, both open source and proprietary. This will benefit VA, in that maintenance and improvements will not be made solely at VA's expense, and will happen at a very rapid pace.

VA will need to provide financial support

VA's contributions will almost certainly include financial support. As part of its active participation in governance activities, VA will need to support the governing entity financially as well as with its active participation and support. Governing services are not free. Different open source governance organizations have a variety of business models. Examples include dues as a requirement for membership, funding to support development or governance of specific products, and external funding – a foundation model. The level and type of financial support VA will need to contribute will largely be a function of the governing body it selects or establishes. But in any case, VA must be prepared to provide the financial support required, along with the broader community of stakeholders.

VA Internal Governance

VA already manages a complex governance process for over 150 deployed instances of the current VistA system. The current set of processes and tools is continually evolving. VA is moving toward a centralized baseline management of the VistA 'gold standard' version that is used in its VA Medical Centers (VAMC's).

Moving to an Open Source solution will increase the complexity of the VA's existing governance and will require senior-level resource support to serve as the VA's official liaison to the VistA 2.0 open source governance organization and the open source VistA 2.0

community in general.

In the current environment, the VA releases VistA through a FOIA process but does not need to be concerned with changes that are being made to that software among the community of users who are consuming this version and extending it. This community must react to any changes VA makes and releases, again through the FOIA process.

When the Open Source model is adopted, the VA becomes one of many stakeholders in an Open Source community that is a consumer of the Open Source VistA 2.0 software. Granted, the VA will be a heavily leveraged and arguably the most important stakeholder, as the VA will be the sponsor and primary contributor of the VistA 2.0 "Core Platform" into the Open Source community. Nonetheless, the "ownership" of the core open source solution becomes external to the VA – an entire community of others with a vested interest in both consuming and contributing to the software. Therefore the VA must establish within the Office of Information and Technology (OI&T) a senior level liaison to the VistA 2.0 Open Source Software (OSS) Community. Figure 4 below is a very high level depiction of how the VA will interact through this Liaison office with the Open Source community and within the VA to manage the VistA 2.0 baselines as they change.

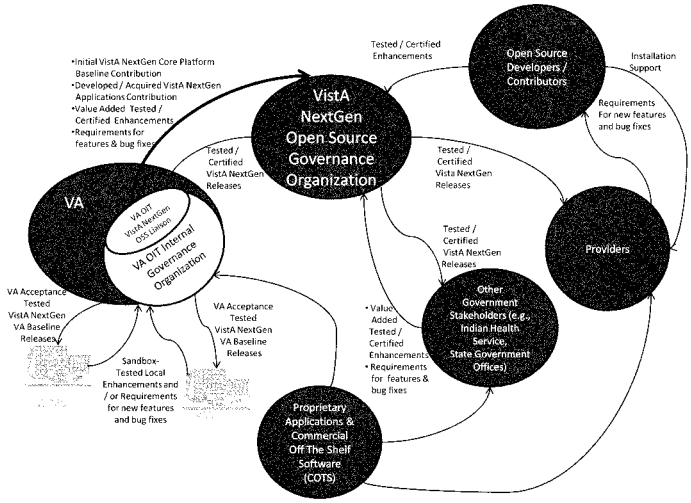

Figure 4 – VA Interaction with Open Source Community and within the VA

As discussed previously, the VA will need to ensure that there are no significant changes implemented within the VA that would cause divergence from the open source version of VistA 2.0. VA's OIT organization will work to ensure that all changes implemented locally are tested at a minimum in the Open Source Organization's 'sandbox' environment and VA's own internal testing environment to ensure that these changes will be compatible with VistA 2.0 and successfully certify to be part of the VistA 2.0 baseline. The VA will work through the governance process to release the value-added changes that have been incorporated into the VA baseline back into the open source community. The VA's OIT VistA 2.0 OSS Liaison will be responsible for establishing and executing the processes necessary to meet this objective. It is also reasonable to expect that this Liaison office will represent the VA's interest at events and discussion groups among the Open Source community and serve as the VA representative participating in the overall governance process for the VistA 2.0 Open Source Governance organization.

Licensing

Open source Governance and Open source licensing are twin concepts that are linked together. In US there are hundreds of open source initiatives being conducted successfully. There are a number of license types championed by various foundations. Some examples of the foundations are Open Source, Free Software Foundation (FSF), Mozilla, Linux, etc.

In general software licenses are either:

- **Proprietary Software**: This license type is used by commercial vendors, such as Microsoft, Oracle etc. The software is licensed for use by a commercial vendor, where a user is permitted to use the software for a fee, but the software is protected (by trade secret, copyright, etc.), and is provided without source code. The user cannot modify, or re-distribute the software without additional special agreements and associated licenses. Examples of proprietary software are the Microsoft Office suite, Oracle Data Base Management system (DBMS) etc. Note that some proprietary software is made available in source code form for free, but additional fees and agreements are required if commercially deployed -- aka proprietary open source.

- **Open Source Software**: Open Source Software is software for which the underlying code, also called source code is available to the users so that they may read it, make changes to it, and build new versions of the software incorporating their changes. There are many types of Open Source Software, mainly differing in the licensing term under which (altered) copies of the source code may (or must be) redistributed. In some open source licenses, the redistribution must be done under the same license as the original, while in other license types the redistribution may be done under different licensing arrangements.

There are a plethora of open source license types, developed by many organizations and authors. The open source software in general falls under three categories depending upon whether (1) one is allowed to link the open source software with a software that has different license, essentially meaning that the user is

allowed to link the original software with another software module only if the linked software can also be licensed under the same terms and conditions as that of the original software or (2) allowed to redistribute the software with a different license. There may be other subtle differences.

- Restrictive Open Source Software: The characteristics of open source software are that it is distributed with source code, along with its binary, and a user is Free to use, Free to modify/change, Free to distribute, free to redistribute after making changes to the source, but under same licensing agreement. The examples of these licenses are Free Software Foundation's (FSF) General Public License V1 (GPLv1), GPLv2, and GPLv3. Redistribution (1) must occur under GPL, with no additional license conditions, (2) Redistribution must also include "source code" and (3) Redistribution must include a copy of the GPL, so that users are aware of their rights to use, copy, modify and distribute, and so that anyone engaged in redistribution is also aware of the conditions under which redistribution is permitted. Essentially the user has to disclose the source code of any software that has been developed if he chooses to redistribute the software. Furthermore the software should be issued under same license agreement as the original.

- Less restrictive Open Source software: It is similar to above, except it allows a user to link this software with the code which has different license, make changes to the software, and redistribute the software under same license. In this license type the licensee is not forced to disclose the source code. Some examples of this licensing arrangement are FSF's Lesser GPLv1, LGPLv2, and LGPLv3, and Eclipse Foundations' Eclipse Public License (EPL). Other example is Open Software License (OSL) v3.

- Non-restrictive License: In this license type user can link the software with this license to other software with different license, make changes to the code, and redistribute the modified software under different license. Essentially the user is not forced to distribute the source code of the modified software, and he can issue the

software under a different software license if he so desires. An example of this license type is Berkley System Distribution (BSD) authored by Regents of the University of California.

For a description of different license types see Appendix 1. The table below identifies and compares some License types that are frequently used.

License	Approved By	Link from a code with different License?	Release changes under different License	Redistribution of the code with changes	Compatible with GPL v3	Authored by
GNU GPL V3	(FSF), OSI	No (Proprietary S/W cannot be linked)	No	Only if the derivative is GNU GPL	Yes	FSF
GNU LGPL V3	FSF, OSI	Yes (since the S/W that is linked is not considered a derivative work)	No	Only if the derivative is GNU LGPL or GNU GPL	Yes	FSF
GNU AGPL	FSF, OSI	No	No	Yes, Only if the derivative is GNU LGPL or GNU GPL	No	FSF
BSD License (Original)	FSF, OSI	Yes	Yes	Yes	No	Regents of the Univ Of California
Modified BSD	FSF, OSI	Yes	Yes	Yes	Yes	?
MIT License	FSF, OSI	Yes	Yes	Yes	Yes	MIT
Apache License Vs 2	FSF, OSI	Yes	Yes	Yes	Yes	Apache Foundation
Common Public License	FSF, OSI	Yes	No	Yes under CPL	No	IBM
Eclipse Public License-	FSF, OSI	Yes	No	Yes Under EPL	No	Eclipse Foundation
Mozilla Public License (Version 1.1)	FSF, OSI	Yes			No	Mozilla Foundation

Table 3 – Frequently Used Licensing Types

A proper selection of license types will strengthen the commercial ecosystem as well as open source community for health related applications development. The selection of one or more license types would be based on the ability to foster open source development and a vibrant open source community based on the VistA 2.0 Platform and tool set. And, at the same time, the ability to foster an equally vibrant commercial or proprietary ecosystem based on the 2.0 VistA Platform and tool set. Ideally, users of the 2.0 VistA Platform would have a wide array of both open source and commercial applications from which to choose. This choice would provide a strong incentive to adopt the 2.0 VistA Platform. In turn, wide spread adoption would encourage the development of additional applications. The capability to incorporate Commercial Off The Shelf (COTS) software in conjunction with open source VistA 2.0 platform version 1.0 is a critical component of the vibrant ecosystem envisioned. This will allow the VA and the broader community using the VistA 2.0 Platform to quickly implement new applications. This requires that the open source license allows linking with proprietary commercial software. The actual licenses adopted should be a decision made by the governing entity (which presumably has intellectual property expertise and experience) in close consultation with VA and other existing and potential stakeholders, consistent with the objectives described above. Examples of this type of license would include Apache License Version 2, Common Public License, Eclipse Public License, and Mozilla Public License (Version 1.1).

Recommendation of the Subcommittee on Governance Models

(1) The subcommittee recommends that the VAcontract with an appropriate FFRDC to establish or identify an external entity to provide governance for the VistA 2.0 platform and for the applications that it makes available as open source. Such governance should encourage and maintain active participation by a wide range of stakeholders.

(2) The subcommittee recommends that the VA establish Governance as quickly as possible after VA makes a commitment to an open source approach.

(3) The subcommittee recommends that the VA take a highly visible and active role in the activities of the governance entity, in the ongoing development of the VistA 2.0 platform, and in the ongoing development of any open source applications running on the VistA 2.0 platform.

(4) The subcommittee recommends that the VA establish rigorous internal governance of its instantiation of the VistA 2.0 platform and applications. The working group recommends that the VA not implement any changes that would cause divergence from the open source version of the VistA 2.0 platform.

(5) The subcommittee recommends that the VA work with the governing entity to identify (from existing licenses) those licenses which will help create and maintain a vibrant "eco-system" of open source and proprietary applications built around the VistA 2.0 platform. Developing new or "VA specific" licenses is strongly discouraged.

(6) Governance of the VistA 2.0 platform should be tightly controlled after it is released into open source, with significant VA input into improvements.

Opportunities and Impacts- Executive Summary

It has been determined by the Open Source VistA Subcommittee on Opportunities and Impacts that there are significant advantages in making VistA 2.0 available to a broader community that could include both government and non-government entities.

The vast majority of the opportunities and impacts identified by the Opportunities and Impacts subcommittee are positive and desirable.

The potential benefits of VistA 2.0 as described in this report far outweigh any potential negative impacts.

Opportunities and impacts related to sharing Open Source VistA 2.0 resources are widespread and include the VA, advanced biomedical entities and multiple public and private health communities and IT communities of practice. Key opportunities include:

1. Revolutionized patient-centric health delivery processes;
2. Interface of health prevention practices with consumer-centric behaviors;

3. Closer integration of evidence-based science in healthcare and health IT that will increase value to other participants or industries related to the healthcare arena; and

4. Value-based accountability and enhanced returns-on-investment (ROI) from Open Source VistA 2.0 implementations

Through collaboration, open solutions and innovation, and the applied strategies and tactics of mutual health IT sharing arrangements revolutionary advancements can be imagined in the areas of

- Semantic Interoperability Systems, Natural Language Processing and Web Technologies.
- Genetic and Genomic Information Systems.
- Nano-technology and Nano-medicine.
- Personal Health Records – Next Generation Web 3.0 Portals and Technologies.
- HealthGrid.
- Healthcare Everywhere – Anytime.

The next generation Ecosystem of Open Source VistA 2.0, can rapidly accelerate the widespread adoption of electronic health records aligned with the nation's goals.

Sharing Open Source VistA 2.0 widely within the U.S. and around the globe will create a "center of gravity" for innovative technologies that can reform and transforming healthcare in America and worldwide.

In conclusion, Open Source VistA 2.0 has the potential to be a game changing advance in the delivery and enhancement of healthcare at the VA, other governmental agencies, public and private sector healthcare delivery systems, research and development entities as well as healthcare organizations worldwide. While the opportunities for transforming healthcare delivery are maturing Open Source VistA 2.0 can serve as a catalyst, incubator, test environment and delivery platform for health communities worldwide. Adopting an open source model for VistA 2.0 will

position the VA to create opportunities for advanced IT development, impact the communities that are transforming healthcare delivery in the 21st Century, take advantage of open source benefits and regain market leadership.

Assumptions

Our effort is not to predict the future, but to point in the direction of what is possible through a stronger, revitalized commitment to share a next generation Open Source VistA 2.0 with healthcare professionals to help accelerate the adoption of EHR's and improve quality healthcare delivery.

The subcommittee assumes the acceleration of EHR adoption through Open Source VistA 2.0 will lead to improved internal and external information sharing for the VA. In turn, the enhancement of information sharing will lead to improved quality of care for Veterans.

Opportunities for sharing VistA with the biomedical science community may lead to the discovery of efficient clinical pathways, advanced medical technology to prevent illness and suffering, hasten healing and wellness, and help to shape the next generation of healthcare delivery.

Relative to Open Source VistA, interfacing with external health IT domains and systems, e.g., genetic and genomic information systems, creates a number of potential constraints that the subcommittee recognizes will require the ongoing attention of the VA CIO and the Administration. These constraints could accelerate or decelerate adoption.

For example, if a major healthcare organization had a security breach and thousands of medical records of veterans or wounded warriors were compromised, this would reinforce current public concerns about privacy and security of EHR's and decelerate the process. Adoption, however, could be accelerated by events similar to Hurricane Katrina or a major bioterrorism event. It is safe to conclude that most Americans, and many people throughout the world, will eventually have EHR's and PHR's – the only question is when.

Even without a major security breach, there are numerous factors that can impact adoption, constraints such as: complexity, lack of

	interoperability, high costs of EHR's installation, and significant change in delivery processes in medical practices and other healthcare settings. The Open Source VistA EHR and Ecosystem could contribute to enhancing or reducing risks relative to such existing conditions.
Analysis Process	The subcommittee explored a broad landscape of the different leading innovations in health IT to guide its analysis. The technique of conducting a web based environmental scan of the literature within health IT, biomedical technology and medical informatics was applied. The process of vetting information was conducted through the contributions of invited subject matter experts most familiar with VistA and open source culture and practices. The result was an efficient analysis of both primary sources, i.e., literature reviews, and secondary resources, i.e., interviews directly with VistA experts in the field. Analyses were recorded and shared with the full working group.
Observations and Outcomes	The Open Source VistA, 20/20 vision and model that the working group articulated will provide a significant step toward the solutions required for an intelligent, empowered and participatory approach to health information technology, improving the costs associated with EHR's and speeding the adoption of EHR's overall. The high-potential opportunities and impacts are already being realized on a limited basis as evidenced by: The Veterans Health Administration, Kaiser Permanente, WorldVistA, OpenHealthTools, different consortiums of small, agile companies and innovators dedicated to services of Open Source VistA implementation, and the abundance of Federal Government agencies like DoD, NIST, DOE, HHS, IHS, etc. are actively deploying Free and Open Source Software solutions and leading development initiatives. Moreover, there have been more the 50 VistA implementations across the public-private sectors in the U.S. and internationally, for example, sites include: West Virginia Bureau for Behavior Health and Health Facilities, Virginia Lakeview Healthcare Systems, University of Hawaii Department of Geriatric Medicine, and Egypt's Cairo National Cancer Institute. The distribution of VistA implementations is illustrated in Figure 5.

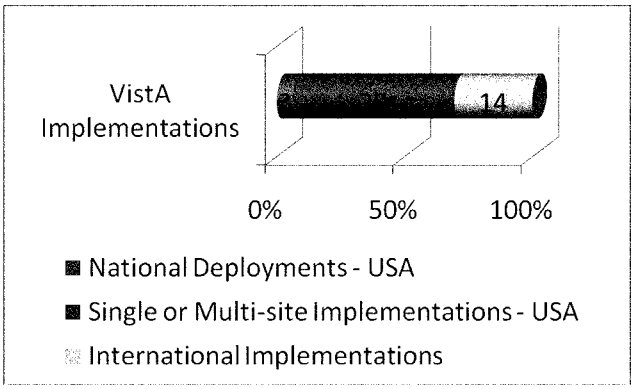

Figure 5- Distributions of VistA Implementations

Following are key observations and benefits that will be realized from taking advantage of the opportunities and harnessing the impacts of the Open Source VistA Ecosystem.

Observations/Benefits of Open Source Solutions

a) Significantly lower and quantifiable Total Cost of Ownership (TCO)- when comparing Open Source VistA Software against proprietary vendor solutions in key software product categories – business, clinical, technical.

b) Enhanced security and interoperability (e.g., meeting HIPAA, NHIN, HITSP, HL7 and other standards) relative to many of the proprietary commercial software products.

c) Continuing growing weight of global public and private support around Open Source VistA Software products and solutions- including collaborative organizations like Open Source Development Labs, WorldVistA, Free Software Foundation, Open EMR, Open HRE, and Open Health Tools.

d) Rapidly growing number of OSS implementations and success stories in government and the healthcare

arena– many federal, state, local governments, international and private sector healthcare facilities are all using OSS solutions that represent high-potential sharing opportunities.

e) Evolving federal trends, mandates, and executive recommendation - e.g., DOD OSS policy, the President's Information Technology Advisory Council - 2000, HHS and ONC initiatives, the Presidential mandate for widespread use of EHR systems, the breakthrough implementation of an Open Source VistA EHR in West Virginia as a model promoted by CMS Medicaid for other states, and many other instances where use of Open Source Software and next generation Open Source VistA solutions are suggested.

f) Extensive growth in Open Source Software availability, and functionality in many technical and functional areas, e.g., genetic and genomics, Internet2 and HealthGrid.

g) Potential improvement in system performance and reliability (including process change, impact from distinct innovation and quality outcomes) when using next generation open source solutions, based on comparable workloads in a growing number of application areas.

h) Reduction in ongoing staff support and costs- i.e., new software, patches, and other ongoing maintenance and support tasks.

The categories, below, represent the 'opportunities and impacts' that will facilitate distinctive innovations within the VA and among its external public-private sector partners:

OPPORTUNITIES	IMPACTS
Semantic Interoperability Systems and Web Technologies	• Semantics and EHR's will drive the future of interoperability supporting accurate content and situational timing for open source VistA 2.0
	• Application of semantic technology to the medical domain will provide IT systems with the ability to better understand terms and concepts as data is transmitted from one system to another

Open Source VistA 2.0 Impact Acceleration of PHR's	• Rise of PHR systems will play a key role in the evolution to a more holistic, integrated person-centered healthcare system • Numerous collaborative projects
Genomic Information Systems	• Intense collaboration between public and private sector organizations • Use of standards and open source solutions to accelerate the integration of computerized patient records with genomic biorepositories, bioinformaticists will allow the development of sophisticated applications that will truly transform healthcare delivery in the 21st century
Nanotechnology/ Nanomedicine	• Nanomedicine deals with comprehensive monitoring, control, construction, repair, defense and improvement of human biological systems at the molecular level using engineered nanostructures and nanodevices • Early nanomedicine applications include: focused pharmaceutical delivery systems; "laboratories on a chip" that perform multiple medical tests invitro or invivo; health related imaging nanodevices; nanosurgical tools; and nanotechnology implants and tissue scaffolds. Currently available health-related products using nanotechnology include burn and wound dressings, water filtration, a dental-bonding agent, and sunscreens and cosmetics.
Healthcare@Everywhere in the 21st Century	The Following are specific opportunities of innovation technologies that should be supported through Open Source VistA next generation: Smart eHealth; Record Systems; eHealth Advisors (eHAL); Complementary and Alternative Medicine (CAM); Genetic Information Systems &BioRepositories; Wearable Intelligence Technology Systems (WITS); and eHealthcare&Telehealth; Robotics; and Standardization.

Table 4 – List of Opportunities and Impacts

Recommendation and Conclusions of the Subcommittee on Opportunities and Impacts

In summary, the subcommittee validated the VA's interests in implementing Open Source VistA and advanced IT solutions that would help them deal with the major challenges facing them. The exemplary areas of advanced information technology presented in this report provide high potential resources for VA to collaborate, share, and add value to the transformation of healthcare, especially in caring for and aiding the lives of millions of wounded warriors, veterans, their families and communities.

The VA must lead the way with the Open Source VistA Ecosystem, providing the industry with the tools to transform healthcare. Likewise, the VA must harness the innovations made by public-private sector partners working within the modernized Open Source VistA Ecosystem, by disseminating them freely across the Veterans Health Administration network providers and among its patients and families, and affiliated institutions from the private sector.

A robust open source market for EHR systems is maturing and gaining momentum in commercial and public sector healthcare communities around the world. Organizations including public health, small and rural providers, hospitals systems and clinics, veterans and their families and wounded warriors are well positioned to take advantage of the numerous opportunities that will truly transform healthcare delivery in the 21st century. Recommendations presented in this report should prove helpful in developing the justification for investment in these new systems.

Appendix I- References and Supporting Material

Executive Summary:

Longman, P. *Best Care Anywhere*. PoliPoinPress, LLC. Sausalito, CA. 2007

Modernization and Architecture:

Architectural Principles

Architecture principles provide a framework for making decisions when making trade-offs becomes necessary. Each principle contains a rationale (why the principle exists) and a set of implications (things that must be done to implement the principle). The modernization and architecture subcommittee have adopted the following principles:

1) First do no harm from the clinical perspective
   a) Rationale: VistA is a superior product that provides best of breed services for Veterans, care providers and healthcare administrators; its functionality and performance should not be compromised.
   b) Implications: Changes to VistA must be carefully planned and expertly executed to avoid compromising Veterans healthcare. From a clinical perspective, evolution is better than revolution.

2) Implement systems and services with low coupling
   a) Rationale: Current brittleness in VistA can be traced to the high degree of tight coupling among various components. Complexity in maintenance and improvements is also traceable to tight coupling. De-coupling systems and services improves agility of maintenance and reduces failures due to brittle structure
   b) Implications: Architectural boundaries must be identified and protected. Tight coupling (e.g. RPC and embedded services) will have to be taken apart and re-structured

3) Maintain and increase cohesion
   a) Rationale: The Electronic Health Record and the Virtual Lifetime Electronic Record represent a highly cohesive information base for VistA. Interoperability among medical

facilities depends on a high level of semantic interoperability. This has been partially compromised by the high level of customization supported by VistA.

b) Implications: The degree of customization (especially where data is concerned) must be managed more closely; especially where the information is shared. The ability to customize information must be viewed in the context of being shared globally. Dynamic semantic translation technology needs to be explored.

4) Maintain lowest possible total cost of ownership
   a) Rationale: Open Source keeps cost of ownership low and allows VA to maintain control of the upgrade path. The total cost of ownership, when development activities are included is increasing and becoming an inhibitor to provisioning of new features
   b) Implications: To manage the cost of ownership, VA needs to control development costs as well. An Open Source environment for VistA could contribute to an overall lower cost of development to VA. This also has significant organizational implications to the VA. However, COTS can lower the total cost of ownership (e.g. transaction managers, services busses, reporting engines, data base management) are better purchased than built

5) Surround and bound VistA modules – get control of the interfaces (logical partitioning)
   a) Rationale: Brittleness in operations and agility in software maintenance can be overcome through tight management of stable interfaces, contract based specifications and decoupling of interfaces
   b) Implications: Service contracts need to be explicitly established and managed. Interfaces need to be stable. Protocols need to be concise, minimal and stable. Interfaces not adhering to the contract need to be removed (e.g. rogue interfaces). Decoupling of modules needs to be aware of performance requirements.

6) Commoditization of the hardware environment
   a) Rationale: VistA's common services operating environment (e.g. DEC Alpha) is dated and represents a high risk to future innovation. The operating environment must be upgraded to support commodity hardware and operating

systems. This will allow the VistA environment to become standardized and to support current and emerging technologies (e.g. Grid, Cloud, etc.)

b) Implications: the VistA modernization activities must address common services architecture and technology if VistA 2.0 is to be viable in the long term.

7) Commoditization of software services – buy or build
   a) Rationale: The VA has built many features and functions (which must now be maintained) and which are readily available either through open source or COTS. The current Core, while increasing flexibility, it greatly increases development cost and generally provides less features than many commercial products
   b) Implications: A SWOT analysis of each VistA common service/package should be conducted to determine what capabilities or collection of combined capabilities should survive. Architects have to consider best-of-breed versus best-fit when considering the architecture for the new services within the Core. Vendor dependence and "lock-in" become major risks even in the case of open source tool selection and needs to be managed. Not all open source and COTS products support a common set of services which is a major consideration as the VA may choose to incorporate proprietary components to address VA specific needs.

8) Automate Performance Monitoring and Reporting
   a) Rationale: VistA's is perceived to be a high performing system (for data reads). Moving towards an open, standards based services environment has risks. Performance monitoring and reporting should be built into the environment and be automatic, customizable and manageable at the interface level
   b) Implications: Meaningful and high-impact performance variables must be identified and a framework developed to measure and report on these variables should be instantiated. Most modules will have to be upgraded to support monitoring and reporting.

Adopting these architectural principles, regardless of which formal modernization path is taken, will promote innovation and the ability to accept innovation from multiple sources. Working in conjunction

with the Alternatives Subcommittee, the M&A Subcommittee has evaluated the proposed alternatives and has compared and contrasted their relative architectural merits.

The benefits of such an inclusive approach as outlined in the executive summary offer the ability to promote both innovation and parallel development:

- From within the Office of Information & Technology (OI&T),
- Amongst the field such as clinicians who are technology savvy or clinicians coupled with information technology professionals – traditionally known as Class 3 Development, as well as

Developers outside of the VA who want to contribute or leverage upon the environment.

Evaluation of the Options

First, we must recognize that doing anything to VistA is a high risk proposition that has the potential to put patient safety at risk. Second, it is apparent that the clinical functionality must be protected. The evidence leads the subcommittee to conclude that much of the problem lies within the architecture of the VistA Common Services. Prudence mandates that we deal with high-risk architecture and modernization decisions early. Several competing options have been evaluated:

1) Get control of the interfaces -- Mumps© provided one the most flexible interface mechanisms of its day (but by no means unique in that aspect); this is both a blessing and a curse. Through "rogue" interfaces, it has become impossible to maintain common business rules or common data standards. Access to common services must be tightly controlled; the VA must offer a tightly controlled, but rich set of standard interfaces. The subcommittee will use the term logical partitioning for this option. Without controlling the interfaces and the data standards, maintenance, innovation, performance and interoperability will continue to be elusive.

2) Decouple the existing clinical modules from the common services. The subcommittee uses the term physical decoupling for this option. Once the clinical functionality is decoupled from

both the common services as well as other clinical modules, maintenance, testing and stability should dramatically increase.

3) Modernize the Common Services and kernel as a complete package (not evolutionary). The subcommittee terms this the iPhone option. The VA needs a standardized, stable, modern platform on which to build the VistA 2.0 ecosystem. With a superior platform that exposes a rich set of functionality through stable interfaces; the VA positions the platform for innovation. We would like to believe that with this option, the VA too can tell the clinicians "there is an app for that."

4) VistA 2.0 should be standards based; that is to say any set of services that adhere to VistA standards (esp. service and data contracts) should be acceptable to the VistA community. This implies that both open source and COTS products could be used to fulfill any functional requirement.

5) VistA 2.0 should become an open source product. If the VA is serious about innovation; it needs to establish a wider community of developers. Open Source is one mechanism through which this can be achieved. This path, however cannot compromise on option 1.

6) The VA should not build those things that it can obtain (open source or purchase) (subject to 1 and 4 above).

7) The VA should supply a software development kit (SDK) to allow all developers to access common services through the stable, controlled interfaces – this will allow "class 3" software to peacefully coexist within the ecosystem.

8) The VistA ecosystem should migrate to "commodity" hardware that is current and viable.

9) The VistA ecosystem should migrate to "commodity" software development technologies to increase the availability of development resources.

10) Produce a baseline architecture and ensure strict adherence to the same for VistA development and deployment.

11) Standardize the interfaces and provide guidelines for

development of new interfaces

12) Produce a standard data model and data exchange guidelines between VistA and other internal/external systems

13) Standardize "services" and publish the services so that the development community not only aware of the existing services but can build new services using the existing ones

14) The VA should develop and implement a robust performance management and monitoring capability at the interface level. VistA should degrade gracefully as opposed to just failing.

Clearly, the Clinical Users like what they have, and they want more, and they want it now. OI&T, at the same time, wants to maintain VistA as the preeminent clinical system in the world, support rapid innovation, improve functional delivery times and protect this national asset. The subcommittee has conducted a robust debate surrounding these options. We have applied the architectural principles as required to develop a consistent set of recommendations.

Observations and Outcomes

Parallel development without an architectural guide is virtually impossible. There are many open source models (OpenLDAP, JBoss, OpenSolaris, Apache, BSD) that have solved these challenges and gained wide spread acceptance within the public and private sector development communities. To achieve the goals outlined in the aforementioned section and to support OI&T, Class 3 and external development, VistA 2.0 should be derived from a terminal release VistA code base. This will allow the migration to begin. VistA 2.0 open sourced components should be snapshots of the latest VistA 2.0 release under development by OI&T. Future versions of VistA will be based on technology from the VistA 2.0 project. This will allow the VA to expand the developer and user community around VistA 2.0. This can be used to gather input to solve the Mumps© challenge and begin the logical partitioning process for the standard interfaces.

An initial recommendation would be to open source the newly partitioned interfaces of the VistA code base. The VistA 2.0 code base should be released under a common development and

distribution license agreement approved and governed by the VA. One important item which needs to be addressed is what elements get open sourced and what elements don't. There will be system code that should not be open sourced and can be made available only as pre-compiled binary files. This system code is considered to be part of the VistA "core" code base elements which are essential to ensuring the integrity of the composite application and are critical to providing the heath care requirements of the VA. OI&T should plan and expertly execute these core components. Decoupling clinical modules from common services, interface standardization, etc., can be handled through these same processes.

Standardization and migration to commonly used software development and hardware platforms can be handled through a community advisory board comprising of VA personnel and open source community members. This will create constitution for the open source project, provide feedback loop into and out of VistA 2.0 and provide a governance body which ensures the clinical functionality is protected. The community advisory board will also provide a forum for a collaborative, consensus based development, a practical software licensing and validation model, and an aspiration to create high quality software that continues the tradition of the VA being a world class leader in this area. When undertaking standards based development and supporting an open source community, standards cannot withhold any detail necessary for interoperable implementation. As flaws are inevitable in this type of project, it is critical that a process is defined for fixing flaws identified during implementation and interoperability testing. This process needs incorporate any changes into a revised version or superseding release candidate.

The VistA 2.0 program must include source code and must allow distribution in source code as well as compiled form. VistA 2.0 will have components of its architecture that are not distributed with source code as mentioned above. The VA will have a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably or downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program.

Adhering to and utilizing the observations and outcomes surrounding architectural guidance will allow the VA to expand upon general educational and advocacy surrounding Veterans healthcare

and to execute the VistA 2.0 mission.

Deployment Models:

Logical and Physical Deployment Models

Logical deployment models span a continuum from a centralized to a decentralized model as depicted in Figure 6.

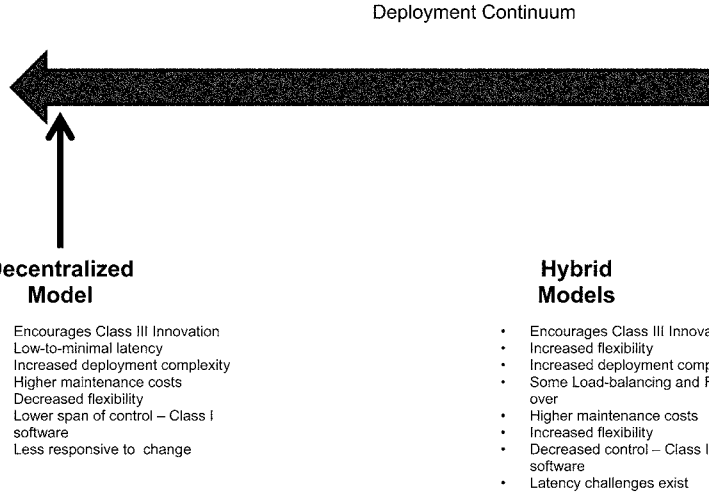

Figure 6 – Deployment Continuum

- ***Centralized Model*** – All system functions are deployed centrally (two or more data centers). The only system component required locally (user's laptop/PDA/workstation) is a web browser that is loaded when the application executes. High Availability is achieved through redundancy and replication of data. When the primary data center fails, a back-up site automatically takes the load. Availability is typically a feature of the system architecture that can be enhanced after initial deployment to include multiple failover

sites or load balancing. Employing a centralized model provides an improved change control capability and eliminates any non-uniformity of software applications within the organization. This alternative requires no software components in the VA Medical Centers or private hospitals participating in the modernized VistA system. There may be some exceptions to this based on the local provider needs for additional capabilities not provided by VistA.

- ***Decentralized Model*** – A version/copy of the VistA 2.0 system will be deployed at each VA Medical Center or provider site. Alternatively, a single instance could be setup a collection of sites belonging to service a specific region. As in the centralized model, the only VistA component required by a user is a web browser that is loaded when the application runs. A central database will house VistA-wide metadata in addition to information aggregates for MI and Administrative purposes. A local database will be used to store some data locally. Connectivity to a central data center/hub is required to exchange information (transaction-based) between medical facilities in real-time and synchronize data between the local and central databases. If a locally deployed instance fails, the site(s) using that system would fail-over to a backup instance within the local deployment context. Advanced capabilities involving fail-over to a centralized instance on-demand could be accomplished through virtualization and comprehensive configuration management.

- ***Hybrid Model*** – All system capabilities are implemented as re-usable and stand-alone/orchestrated services. Services are deployed centrally or locally (regionally) based on level of re-usability. The application including the VistA user interface is built and deployed centrally and invokes centralized or local services to accomplish all business processes. Services deployed centrally will be deployed with fail-over and load-balancing capabilities similar to the centralized model (multiple data centers). Services deployed locally (or regionally) will be managed as in the decentralized model from a fail-over/load-balancing perspective. A Service Bus, in cooperation with rules-based decision support and monitoring tools will provide invocation and orchestration services. For example, invocation could be

based on a service level requirement, history of response time performance, security constraints, service availability, or other similar factors. In this model, services are not directly invoked by the VistA client/presentation layer. For example, even though a service might reside in close proximity physically (locally or regionally deployed service), to a particular application instance, it is virtually invoked from the centrally deployed VistA instance.

Physical deployment models – Traditional models comprise of a combination of computing hardware and software installed and configured to host business applications such as VistA. As cloud computing and virtualization technologies mature, the XaaS model is increasingly becoming commonplace. The 'X' in XaaS takes form of 'I' for Infrastructure, 'P' for Platform and 'S' for Software with several business and technical advantages including cost savings, ease of maintenance and deployment, flexibility and integrated security.

- ***Infrastructure as a Service (IaaS)*** – Refers to the delivery of computer infrastructure (typically a platform virtualization environment) as a service. Rather than purchasing servers, software, data center space or network equipment, computing resources are acquired on-demand as a fully outsourced service. The service is typically billed on a utility computing basis and amount of resources consumed (and therefore the cost) will typically reflect the level of activity.

- ***Platform as a Service (PaaS)*** – Refers to the delivery of a computing platform and solution stack as a service. It often goes further than IaaS with the provision of a software development platform in addition to hardware resources. It facilitates deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers, providing all of the facilities required to support the complete life cycle of building and delivering web applications and services entirely available from the Internet.

- ***Software as a Service (SaaS)*** – Refers to a model of software deployment whereby a provider licenses an application to customers for use as a service on demand. SaaS software vendors may host the application on their own web servers or download the application to the

consumer device, disabling it after use or after the on-demand contract expires.

Figure 7 illustrates how several combinations of physical models can be leveraged to deploy VistA 2.0 using a Centralized logical model.

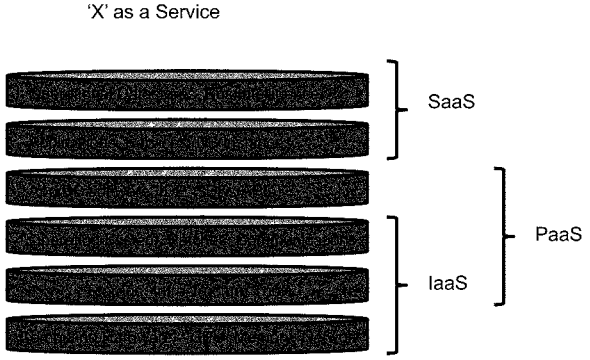

Figure 7 –Combination of Physical Models Leveraged to Deploy VistA 2.0 using a Centralized Model

Deployment Activities

Careful consideration should be provided to the following Deployment Activities regardless of the specific Model or Architecture that is adopted for the "VistA 2.0". To accommodate the various 'end user' communities, large Health Centers, regional Hospitals, or small Clinics and Doctor's Offices a variety of logical, physical, and business models may be required without sacrificing any loss of current functionality. The determination of whether to deploy a logical or physical model will depend upon which model best suits the specific mission needs and targeted end users. The following Deployment Activities should be considered:

Release - The release activity follows from the completed development process. It includes all the operations to prepare a system for assembly and transfer to the customer site. Therefore, through a site survey, it must determine the resources required to operate at the customer site, prepare a requirements definition document and collect information for carrying out subsequent activities of deployment process through the implementation plan. It

is this chain of artifacts upon which delivery acceptance will be based that define a successful delivery of the release.

Install and Activate - Activation is the activity of starting up the executable component of software. For a simple system, it involves establishing some form of command for execution. For complex systems, it should make all the supporting systems ready to use. This can be achieved using configuration control software such as Subversion that can maintain the software based for various types of installations, and provision from the Internet. As the configuration changes, the changes can also be provisioned to the client.

In larger software deployments, the working copy of the software might be installed on a production server in a production environment. Other versions of the deployed software may be installed in a test environment, development environment and disaster recovery environment. The install and activate process should include the following:

- Identify each component of the application
- Identify the deployment steps of each component(s)
- Identify the implementation/installation process for each component (order)
- Identify testing of each component deployment step (Validation that the implementation/installation step completed successfully)

Critical Components - Identification of components that are critical to the application. These are the identified items/steps/components that are of a critical nature for proper functionality of the application without major restrictions or outages. These are to be identified and noted as critical components.

Test - Testing should include both unit testing of all components comprising of the solution or systems. Performance testing should be completed to validate production load. Each phase of testing should follow test plans designed from the solution requirements and developed during the analysis and design phase prior to deployment (both application and security). Testing should be completed both during the implementation process as well as after the security/lockdown process is completed.

Testing is but a stage in the deployment's configuration. Subversion may also be used to support testing, and when testing

is successful, the same system settings may be used to deploy the release.

Feedback Loop - Once in production, a Feedback Loop should be implemented as a method to retrieve end user feedback and develop future requirements for subsequent versions of the solution. This feedback should occur within an Issue Tracking system. The working group recommends that the VA consider an Open Source Issue Tracking package that can track issues as well as desired refinements and processes to resolve issues. Without such a system, issues are passed through word of mouth and take longer to fix. This system should be accessible by all relevant stakeholders in the solution including developers, managers, information officers, operations, and security personnel.

Change Control - Change Control processes and procedures are required to assure dependable and positive impacts are felt during adaptations, upgrades, and updates. This includes a multi-step process called a Change Control System that identifies, reviews, discusses, and plans the implementation of any changes that may affect the configuration of a deployed production system.

Knowledge Transfer - Knowledge Transfer is a vital step to the success of any significant systems implementation. This step allows for the introduction of technology and the processes that support the maintenance of that technology to the team chartered with operating that system throughout the system's lifespan. This knowledge transfer should include some form of formal training on any open source products as well as less formal training on the specific implementation of those technologies in the production deployment. The deliverables for this activity should also include complete systems documentation and operational manuals. The use of Web 2.0 based tools that support user comments and the discussion of problems is highly effective.

Deactivate - Deactivation is the inverse of activation, and refers to shutting down and removing executing components of a system. Deactivation is often required to perform other deployment activities, e.g., a software system may need to be deactivated before an update can be performed. The practice of removing infrequently used or obsolete systems from service is often referred to as application retirement or application decommissioning. Before "software" is deactivated, an analysis should be performed to

determine the consequences that may be experienced from deactivation.

Adapt - The adaptation activity is also a process to modify a software system that has been previously installed. It differs from updating in that adaptations are initiated by local events such as changing the environment of customer site, while updating is mostly started from remote software producer. In many cases, as software is adapted, it tends to out-perform itself and be used in new and interesting ways for which it was not originally intended. Open Source software adaptation is part of the culture and ongoing life-cycle of the software.

Update and Upgrades - The update process replaces an earlier version of all or part of a software system with a newer release.

Built-In - Mechanisms for installing updates are built into some software systems. Automation of these update processes ranges from fully automatic to user initiated and controlled. Norton Internet Security is an example of a system with a semi-automatic method for retrieving and installing updates to both the antivirus definitions and other components of the system. Other software products provide query mechanisms for determining when updates are available.

Version Tracking - Version tracking systems help the user find and install updates to software systems installed on PCs and local networks. Web based version tracking systems notify the user when updates are available for software systems installed on a local system. For example: VersionTracker Pro checks software versions on a user's computer and then queries its database to see if any updates are available. Such version trackers can work with the Subversion system to get updates as they become available.

Local version tracking system notifies the user when updates are available for software systems installed on a local system. For example: Software Catalog stores version and other information for each software package installed on a local system. One click of a button launches a browser window to the upgrade web page for the application, including auto-filling of the user name and password for sites that require a login.

Browser based version tracking systems notify the user when

updates are available for software packages installed on a local system. For example: wfx-Versions are a Firefox extension which helps the user find the current version number of any program listed on the web.

Uninstall – Un-installation is the inverse of installation. It is a removal of a system that is no longer required. It also involves some reconfiguration of other software systems in order to remove the uninstalled system's files, registry, and dependencies

Retire - Ultimately, a software system is marked as obsolete and support by the producers is withdrawn. It is the end of the life cycle of a software product and requires a retirement date for application. The choice of a ***Systems Development Life-Cycle (SDLC)*** is critical to successfully implement and deploy VistA 2.0 based on an open architecture. While there are several traditional SDLC methodologies to choose from, large and complex organizations like the VA often define and customize their own version(s) of the SDLC methodology to best meet their needs. Table 5 illustrates the key SDLC methodologies and their pros and cons.

Methodology & Criteria	Advantages	Disadvantages
Waterfall **Budget: High** **Time: Long Term** **Functionality: Static**	➢ Clearly defined stages ➢ Assures delivery of initial requirements ➢ Well documented process and results	➢ Lack of measurable progress within stages ➢ Cannot accommodate changing requirements ➢ Resistant to time and/or budget compression
Incremental **Budget: High** **Time: Short Term** **Functionality: Static** **or** **Budget: Low** **Time: Long Term** **Functionality: Static**	➢ Early and periodic results ➢ Measurable progress ➢ Supports parallel development efforts	➢ Demands increased management attention ➢ Can increase resource requirements ➢ No support for changing requirements
Evolutionary **Budget: Low** **Time: Long Term** **Functionality: Dynamic**	➢ Supports changing requirements ➢ Minimizes time to Initial Operating Capability (IOC) ➢ Achieves economies of scale for enhancements	➢ Increases management complexity ➢ IOC only partially satisfies requirements and is not complete functionality ➢ Risk of not knowing when to end the project

Methodology & Criteria	Advantages	Disadvantages
Spiral **Budget: High** **Time: Long Term** **Functionality: Dynamic**	➢ Supports changing requirements ➢ Allows for extensive use of prototypes ➢ More accurately captures requirements	➢ Increased management complexity ➢ Defers production capability to end of the SDLC ➢ Risk of not knowing when to end the project
RAD (Rapid Application Development) **Budget: High** **Time: Short Term** **Functionality: Dynamic**	➢ Minimizes time to delivery ➢ Accommodates changing requirements ➢ Measurable progress	➢ Increases management complexity ➢ Drives costs forward in the SDLC ➢ Can increase resource requirements
Agile/Scrum (Roger mentioned that the VA is currently pretty happy with results and sees this as the future of SDLC at the VA)	➢ Provides more insight to the development/configuration work being completed and allows for risk management at a more granular level. ➢ Allows for more collaboration and adaptation to changing business needs - avoids "Paralysis - Analysis".	➢ Requires more IT governance oversight, leading to the need for more management / PMO resources (i.e. money). ➢ An investment committee will need to ask themselves - will the additional investment of process oversight and management return better rewards? What will be the impact to deployment timelines? What's the expected cost savings in the end, due to risks being mitigated?

Table 5 – Selecting an SDLC Framework

The Veterans Affairs typically utilizes a waterfall/iterative approach to SDLC. Today, the typical VA project defines the following high-level phases:

- Concept Definition (Phase 0)
- Requirements Development (Phase 1)
- System Design and Prototype (Phase 2)
- System Development and Testing (Phase 3)
- System Deployment (Phase 4)
- System Operation (Phase 5)

Each phase has a specific purpose, entry and exit criteria, and other special considerations.

Recently, the VA has found success with the adoption of Agile methodologies. The open-source approach recommended to implement VistA 2.0 will spur innovation both within the VA and the healthcare community. Continual integration with such innovations requires organizational practices to align with incremental bursts of development, configuration and deployment in addition to risk management at a more granular level. Agile methods allow for more collaboration and adaptation to changing business needs.

It is recommended that the VA continue to be flexible with the framework chosen per type of deployment to meet the needs of the end user. This may change based on deployment within the VA vs. private hospitals, or dependent on the modules of VistA being implemented and the source of the solution (e.g., internal VA module vs. open-source module vs. COTS module). A flexible approach to the SDLC in the VA environment would potentially be the most successful; assuming, the appropriate governance model (i.e., PMO resources) is put into place.

Deployment Pillars

The size and complexity of the Department of Veterans Affairs and the requisite implications for the VistA 2.0 system are best illustrated by building deployment activities around five pillars. These pillars are identified as; ***Reliability/Availability, Maintainability/Support, Scalability, Extensibility and Interoperability***. The foundational model to best support these pillars is accomplished most efficiently through a Centralized Model for deployment of applications. This Centralized Model is already well underway at the Department of Veterans Affairs through the National Data Center Program with the co-location and consolidation of VistA.

Healthcare is predicated on the efficient interaction between the patient and the caregiver. With over 150 medical centers and over 6,000,000 visits annually the reliability and availability of the VistA applications is of critical importance to providing care for the veterans and dependents. The centralized model; be it through cloud computing, Application Service Provider (ASP), or virtualized client-server, must have performance metrics associated with the applications before and after the consolidation efforts to understand the physician and veterans experience. These performance measurements can help develop the necessary baselines and Service Level Agreements to quantify performance improvements with the consolidation of VistA apps. This information also enables

the Office of Information Technology (OIT) to strive to continuously improve the delivery of service through historical information to enable troubleshooting and triage of applications.

The past experience of the VA highlights that trying to support a separate instance of VistA at each Medical Center (MC) results in an unsustainable economic model for maintenance and resources necessary to maintain the hundreds of VistA instances. The centralization and consolidation of VistA will result in a significant cost savings for maintenance and time spent in applying patches and/or new version of the multiple applications. If VistA is to continue to be the Electronic Health Record (EHR) application that provides the most comprehensive medical information for VA physicians and veterans then the Maintainability/Supportability pillar inevitably leads to further consolidation.

The current efforts of consolidation in the VA and moving to a more cloud based approach will increase the Scalability of the apps to meet the increasing number of veterans using the system. Under a typical client server approach to scalability the applications very quickly reach an untenably complex infrastructure that continues to add risk to delivering care to the Veteran. While the limitations of physical scalability resulted in the consolidation of VistA into several data centers the interoperability of the applications has become even more important. With Veterans receiving as much as 75% of their care through non VA hospitals the ability to exchange information with private entities has resulted in many new mandates around interoperability. These interoperability requirements are best addressed through a Service Oriented Architecture based on standards and certifications that enable the secure cross domain exchange of electronic protected information and/or personally identifiable information.

As the needs of the Veterans evolve it is also necessary that the systems that contribute to care are able to evolve in a similar manner. Therefore, the Extensibility of the VistA 2.0 application must be taken into considering when deploying to the enterprise. In addition to distributing the apps in a centralized manner the development environment must accommodate both open source and COTS based applications. The open source nature of the deployment model enables the integration of the "next great" application and follows the Apple model that has proven successful in driving innovation in the public arena.

The adherence to the five pillars listed above can help ensure greater adoption by the caregivers in the Department of Veterans Affairs. Though the history of VistA has been problematic from the Information Technology and support perspective it has proven to be a big success with physicians providing care to Veterans. Most of the positive commentary about the VistA system stresses the ease of use and comprehensive nature of the system. These are key attributes that must be enhanced in any new system and not impacted by any deployment model. The more transparent and non-disruptive the new system is the greater the chance of adoption by the VA's fiercest critics; the caregivers.

Deployment Environment- Innovation Sandbox

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Governance:

1. Open Source software " A primer for healthcare leaders" by Forrester consulting in March 2006 prepared for California Healthcare Foundation by M.Goulde, and Eric Brown, available at http://www.chcf.org/documents/healthit/OpenSourcePrimer.pdf This report examines the development and distribution of open source software, and describes how it may help healthcare providers to overcome the problems of incompatible IT systems that can disrupt the smooth exchange of Information.

2. OSL 3.0 " A Better License for Open Source Software" by Lawrence Rosen 2005, available at http://www.rosenlaw.com/OSL3.0-explained.pdf

3. Free Software Foundation. "Various Licenses and Comments about Them", available at http://www.gnu.org/licenses/license-list.html

4. The text of the licenses that are approved by OSI for approval is provided at http://www.opensource.org/licenses/alphabetical.

5. Open Source Licenses comparison by Zack Rusin available athttp://developer.kde.org/documentation/licensing/licenses_summary.html

6. Framework for Governance in Open Source Communities byChristophLattemann and Stefan Stieglitz,Potsdam University, available athttp://freesoftware.mit.edu/papers/Governance-in-OpenSourceProjects.pdf

7. "Open Innovation's Challenge: Letting Go Is Hard To Do"

Business Week, April 1, 2010http://www.businessweek.com/innovate/content/mar2010/id20100330_486211.htm

8. The Cathedral & the Bazaar : Musings on Linux and Open Source by an Accidental Revolutionary, Eric S. Raymond& Tim O'Reilly, O'Reilly Media, 2001

9. Just for Fun: The Story of an Accidental Revolutionaryby LinusTorvalds and David Diamond, HarperCollins, 2001

Opportunities and Impacts:

Mission Statement
Examining the Ways to Improve Healthcare through Open Source VistA 2.0 and Identifying the potential Opportunities and Impacts of VistA 2.0 implementation

Daniel Johnson, MD wrote in, "Medical Enterprises and Open Source," "The history of the medical community's discovery of the importance of sharing discoveries is a paradigm for what has been more recently developing in the free software or open source community."

The Open Source VistA Working group and Subcommittee on Opportunities and Impacts endorses the strategy of Collaboration, Open Solutions and Innovation in order to succeed with the transformation of VistA to VistA 2.0. Our findings represent our most realistic appreciation of potential opportunities and potential impacts of Open Source VistA 2.0.

A premise of the subcommittee is that the VA can lead the nation's healthcare industry in transforming healthcare delivery and quality of care through sharing VistA 2.0 as Free Open Source Software. Open Source VistA 2.0 will create a robust model for accelerating change, reducing medical errors and improving quality in the U.S. and other countries' healthcare systems.

The subcommittee focused on identifying innovative ways ("opportunities and impacts") that VistA can be modernized and deployed as VistA 2.0 in collaboration with the 'public-private sector' healthcare communities and other key groups. The opportunities for

vigorously sharing VistA 2.0 with biomedical science to discover efficient clinical pathways, advanced medical technology to prevent illness and suffering, and hastening healing and wellness will help generate significant new outcomes, systems, tools and applications.

The question we asked ourselves is, by 2020, how can Open Source VistA 2.0 serving as a Gold Standard Health Information System (HIS) and Electronic Health Record (EHR) be used to facilitate advancements in healthcare?

The subcommittee's mission is to recommend these converging, advanced information technology routes toward transformation through sharing and collaboration.

It is assumed that by freely sharing and constant communication the knowledge and applied creative power of team members in healthcare organizations nationally and internationally can improve processes and transform healthcare outcomes. VistA 2.0 will accelerate collaboration, encourage open solutions and innovation across the U.S. and around the globe.

The key strategy of collaboration requires VA's rapid movement to mutually engaging sharing behaviors, supporting new open horizons of software development that should be more readily practiced between the VA and the public-private sector that will involve sharing and disseminating VistA as an open source ecosystem platform.

The result will be unprecedented benefits of measurable cost-effectiveness and returns-on-investment of medical and scientific knowledge, capabilities and resources to healthcare leaders, patients and consumers, allowing them to save time and money across the many health and medical industry tiers and markets.

Approach

Listening to Subject Matter Experts and Observing Best Practices

The open source market and open solutions strategy and tactics are growing modestly and can be stimulated to grow rapidly across different markets. The opportunity is for the VA to lead the modernization and deployment of VistA 2.0, especially for public

hospitals and clinics, providers in rural and underserved areas and individual and small medical practices in order to implement the meaningful use of EHR's. In accordance with the HITECH Act and requirements for adopting EHR's, these providers are least likely to be able to afford the costs of traditional proprietary EHR's and most likely to benefit from the availability of a next generation Open Source VistA 2.0 ecosystem.

The subcommittee approach to identifying opportunities and impacts with modernizing and deploying VistA 2.0 was to go directly to the people and organizations which would benefit the most from an open source EHR and open solutions. Key contributing factors for this demand for an Open Source VistA 2.0 ecosystem are the growing awareness of the benefits of open source as less costly, innovations in the power of IT that will transform healthcare delivery, increased functionality, increasing adoption, and the ability of Open Source VistA 2.0 to operate at the enterprise or Health Information Exchange (HIE) level. The increased functionality has resulted from high-profile alliance and coalitions among advanced IT communities of practice both in the U.S. and internationally.

In summary, the subcommittee's approach is outlined as follows:

- Conferred and agreed to survey of key articles, reports and activities important to demonstrating the high potential methods, techniques and beneficial outcomes related to sharing VistA.
- Identified and interviewed subject matter experts from the government, industry and non-profit sectors, approximately 20 including subcommittee and working group level engagements.
- Developed "Opportunities and Impacts Guidance Questions and Answers," providing a foundation for justification and rationale supporting the line of analysis and recommendations regarding VA's sharing advanced IT innovations between the public and private sectors.
- Conducted extensive market research and environmental scan of key targeted articles, literature and communities of practice related to health IT open source methods, communications and innovation.
- Facilitated discussion driven by the Open Source VistA Working group's chartered priorities to establish insight to current and future deployments of VistA Open Source and other EHR

systems.
- Identified high potential collaboration opportunities and impacts within biomedical domains for integrating Open Source VistA in the public-private sector healthcare communities, markets and other interested groups.
- Gained consensus of conclusions and recommendations through presentation and discussion with the Open Source VistA Working group.

- **Semantic Interoperability Systems, Semantic Web Technologies and Open Source VistA**

The set of technologies associated with semantics and ontologies in healthcare are, relatively speaking, still in their infancy or early childhood. While there are high expectations, only modest progress has occurred to date.

The VA's creation of Open Source VistA Ecosystem leading partnerships between major technology vendors such as commercial database companies and large scale integrators, working in collaboration on public-private sector EHR projects, will help break through some of the existing major barriers.

With the ease of posting structured lists on the Internet, and with Extended Markup Language (XML) as an emerging standard for such lists, it is likely that the next decade will witness an explosion of medical ontologies generating faster transactions, more accurate and timely knowledge with less cost available in the public domain.

- **Communities of Practice**

Exemplary Market Opportunities and ImpactsSemantic Interoperability Systems, Semantic Web Technologies and Open Source VistA:

- ProteinOntology http://proteinontology.info/
- WordNet Semantic Lexicon http://en.wikipedia.org/wiki/WordNet
- Foundational Model of Anatomy (FMA Ontology) http://sig.biostr.washington.edu/projects/fm/AboutFM.html
- Systems Biology Ontology (SBO) http://www.ebi.ac.uk/sbo/
- General Ontology for Linguistic Description (GOLD) http://www.linguistics-ontology.org/gold.html
- Gene Ontologyhttp://sourceforge.net/projects/geneontology/

- Center for Clinical Translation Sciences (CCTS) at the University of Texas Health Science Center at Houston; CCTS utilizes Semantic Web technologies not only for integrating, repurposing and classification of multi-source clinical data, but also to construct a distributed environment for information sharing, and collaboration online with security and privacy of personal data. *See* *http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2646248*

• Genomic Information Systems and Open Source VistA

Over the next decade, a great goal for genomics will be to transform knowledge about the human genome into improvements in clinical practice. For a number of years we have collected information on many of the known genomic information systems initiatives and have been monitoring their progress. Numerous federal agencies and private clinical research enterprises engaged in developing genomic information systems are embracing collaborative ventures and open source solutions.

The role of "open" computing and "open" standards will be to support global collaboration between public and private healthcare organizations in this arena, and VA's leadership is critical. Collaborating within this community of genetic researchers, biomedical drug developers and clinicians is essential if substantial progress is to be made over the near term.

In the 2004 Annual Report of Recommendations the of the Veterans Health Administration, Health IT Sharing (HITS) Program, the HITS staff recommended that the VA should begin the exploration for sharing information technology between the DOD and VA for the purpose of integrating genetic and genomic data from military service members with VistA Computerized Patient Record System. These efforts should be expanded through Open Source VistA.

Communities of Practice – Exemplary Market Opportunities and Impacts: Genomic Information Systems and Open Source VistA:

• Armed Forces Repository of Specimen Samples for the Identification of Remains (AFRSSIR) -

http://www.afip.org/Departments/oafme/dna/afrssir/
The Armed Forces Repository provides reference material for DNA analysis to assist in the remains identification process.

- **BLAST** - http://www.ncbi.nlm.nih.gov/BLAST/
  BLAST is a set of Open Source Genomic software applications and databases produced by the National Center for Biotechnology Information (NCBI) and others.
- **DOE Genomes** - http://www.doegenomes.org/
  Genome programs of the U.S. Department of Energy.
- **Genetic Computer Language/Genomic Messaging System** - http://www.haifa.il.ibm.com/projects/software/imr/gms.html

- **Nanotechnology, Nanomedicine and Open Source VistA**

The challenge for interested healthcare organizations is to help governments to formulate long-term strategies that promote the cost effective development of nanotechnology that meets as many needs as possible, especially with regards to healthcare. Early involvement by healthcare provider organizations will prove useful in providing guidance about funding efforts to link nanotechnology solutions to Open Source VistA systems.

Major long-term cost-benefits related to investments in nanotechnology for VA and healthcare include:

- Significant investment must be made over time before achieving major benefits.
- Potential for radical advances in the VA involving medical diagnosis and treatment of such debilitating illnesses as PTSD/TBI, diabetes, heart disease and cancer are high.
- Powerful capabilities built into future health IT systems between VA and the private sector will utilize nanotechnology.
- Improvements in personal health information and personal care products will be driven by evidence-based data at the minute level of biomedical science.
- Early involvement and investment by the VA with Open Source VistA should lead the way ahead following standards and resulting with robust interoperability.

The evolution of nanotechnology will likely involve extensive testing of solutions coupled with consideration of the social and ethical consequences of deploying them. "Like any powerful new technology", says National Science Foundation (NSF) Director Rita

Colwell, "nanotech also has the potential for unintended consequences - which is precisely why we can't allow the societal implications to be an afterthought." In March 2005, a European Commission was launched to promote international dialogue on the social, ethical and legal benefits and potential impacts of nanotechnology.

Other challenges or issues that need to be addressed by the VA through the Open Source VistA Ecosystem include the need for standards, overcoming legal barriers, collaborative research, development of interfaces to health information systems, patient safety, and interoperability to name just a few. Cheaper and higher performing nanotechnology solutions, combined with convenience and greater functionality, will revolutionize healthcare in the coming decade(s) and will change the daily business practices of healthcare organizations and how they provide patient care.

Communities of Practice – Exemplary Market Opportunities and Impacts Nanotechnology, Nanomedicine& Open Source VistA:

- The U.S. Army Institute of Soldier Nanotechnologies (http://web.mit.edu/isn/)
- Employing nanoengineered molecules called "nanolipoblockers" as frontline infantry against harmful cholesterol - is showing promise starting in earlier laboratory studies at Rutgers and The State University of New Jersey. See http://www.physorg.com/news66485379.html
- Nanotechnology and Occupational Health - http://www.cdc.gov/niosh/topics/nanotech/
- NIOSH is the leading federal agency conducting research and providing guidance on the occupational safety and health implications and applications of nanotechnology.
- NASA can share technologies enable nano-sized particles to warn of early developing cancer and genetic diseases. http://science.nasa.gov/science-news/science-at-nasa/2004/28oct_nanosensors/

- **HealthGrid and Open Source VistA**

By 2020, public health information systems in the United States, such as disease registries, will be integrated into grids linked by the

National Health Information Network (NHIN) that will utilize the Next Generation Internet (NGI) or Internet2.

There are a number of ways that grids can potentially be used with Open Source VistA systems over the coming years.

- **(1) *computational grids*** can be used to solve large-scale research problems in healthcare effecting veterans with PTSD/TBI using the unused power of computer workstations of EHR systems in healthcare provider organizations;
- **2) *data grids*** can be established that don't share computing power but instead provide a standardized way to securely exchange patient data internally and externally from EHR systems for data mining and decision support impacting VA's clinical research and development;
- **(3) *collaborative grids*** can be built that let geographically dispersed users share medical information and work together on complex cases using patient data sets and clinical images maintained in EHR systems of multiple healthcare provider organizations benefiting VA's and the private sector's next generation Open Source VistA software development, clinical data systems requirements, and revolutionary practices of medical specialization and consulting for micro-orthopedic surgery, neurosurgery, telemedicine and other advanced technology intensive operations.

Communities of Practice – Exemplary Market Opportunities and Impacts Health Grid & Open Source VistA

Organizations: & Grids:

- Open Grid Forum (OGF) - www.ogf.org
- Globes Alliance - www.globus.org
- HealthGrid.Org - www.healthgrid.org/en.html
- BIRN - www.nbirn.net
- caBIGhttps://cabig.nci.nih.gov/
- DoD Telemedicine and Advanced Technology Research Center (TATRC)
  The methodology for this Integrated Research Team is the pairing of biomedical and Grid expertise, to underscore the point that biomedical research can be accelerated and enhanced through collaborative and cooperative arrangements, and the VA and Open source VistA presents the best opportunity for Health Grid advancement

in a medical setting.
http://www.tatrc.org/website_healthgrid05/index.html

- **Personal Health Records (PHR's) and eHealth, Everywhere-Anytime**

We are seeing a major sea change at work. Smartphones, health apps, implantable technologies, wearable systems and other mobile solutions are going to bring about changes we may find hard to imagine. This is a real movement. Cerner, CPSI, Eclipsys, Epic, GE Healthcare, McKesson, Meditech and Siemens have all been steadily expanding their footprints in the mobile health information technology space.

In order for the VA to stay timely and remain as a leader with consumer demands, it becomes imperative to modernize through Open Source VistA collaboration and sharing with Mobile eHealth using new applications and tools ready to assume the functions of PHR's.

We are seeing a major sea change at work. Smartphones, health apps, implantable technologies, wearable systems and other mobile solutions are going to bring about changes we may find hard to imagine. This is a real movement. As mobile phones and other mobile devices become part of everyday life, people become better equipped to respond to emergencies, consult with peers and health professionals about health issues as they arise, and access health services that are increasingly being delivered through mobile phone based systems.

Our soldiers and wounded warriors are accustomed to using the advanced Web apps and tools delivered and operated through cell devises and virtual reality games.

These new mobile applications, bypassing the fixed-line solutions, are creating new pathways for sharing health-related information. Mobile technologies will contribute significantly to the revolution in healthcare over the coming decade and will change the daily business practices of healthcare organizations and enhance how they provide patient care. They will also start to be used and dramatically impact the lives of everyday citizens and wounded warriors. The Open Source VistA Ecosystem can become the public-private sector's go-to place to

promulgate the design, development and dissemination of Mobile eHealth IT supporting PHR's.

Communities of Practice – Exemplary Market Opportunities and Impacts
Mobile eHealth and PHR's

These are some PHR-oriented apps and tools representative of how Open Source VistA can be used to advance innovation based on the VA's foundational architecture:

- Epocrates Rx: http://www.epocrates.com/products/rx/
- DoctorCalc: http://doctorcalc.com/
- MedicTouch is the developer of the first cellular wearable health and wellness devices that allows users to monitor their pulse, view the results in a high-resolution screen on a Java technology-enabled mobile phone, and transmit the data to a Java compliant server. www.medictouch.com/news
- TrixieTracker can help track a baby's health needs to be shared with physicians.
- http://www.apple.com/webapps/utilities/trixietracker.html

Appendix II- Terms and Definitions

Application Programming Interface (API)– is an interface implemented by a software program to enable its interaction with other software. It is similar to the way the user interface facilitates interaction between humans and computers. APIs are implemented by applications, libraries and operating systems to determine the vocabulary and calling conventions. The programmer should employ it to use their services. It may include specifications for routines, data structures, object classes, and protocols used to communicate between the consumer and implementer of the API

Class III Software –Inside VA's VistA, Class III software is locally developed, supported and installed software. This is as opposed to mandatory or "Class I" software, which is developed and supported centrally. Class III software allows individual VA Medical Centers to develop applications for their own use, and is an important source of innovation. In some cases, Class III software has been of sufficient value to be converted to Class I software – that is, adopted for use system-wide, and centrally supported.

Federally Funded Research and Development Center (FFRDC) -

A Federally Funded Research and Development Center (FFRDC) is a unique organization that assists the United States government with scientific research and analysis, development and acquisition, and/or systems engineering and integration. FFRDC's address long-term problems of considerable complexity, analyze technical questions with a high degree of objectivity, and provide creative and cost-effective solutions to government problems. FFRDC's are administered in accordance with U.S Code of Federal Regulations, Title 48, Part 35, Section 35.017 by universities and corporations. For the most up to date master list of every FFRDC, please view the following website: http://www.nsf.gov/statistics/ffrdclist/start.cfm

Open Source Software [License]–Open Source Software is software for which the underlying code, also called source code is available to the users so that they may read it, make changes to it, and build new versions of the software incorporating their changes. There are many types of Open Source Software, mainly differing in the licensing term under which (altered) copies of the source code may (or must be) redistributed. In some open source licenses, the redistribution must be done under the same license as the original, while in other license types the redistribution may be done under different licensing arrangements.

Proprietary Software [License]This license type is used by commercial vendors, such as Microsoft, Oracle etc. The software is licensed for use by a commercial vendor, where a user is permitted to use the software for a fee, but the software is protected (by trade secret, copyright, etc.), and is provided without source code. The user cannot modify, or re-distribute the software without additional special agreements and associated licenses. Examples of proprietary software are the Microsoft Office suite, Oracle Data Base Management system (DBMS) etc.. Note that some proprietary software is made available in source code form for free, but additional fees and agreements are required if commercially deployed -- aka proprietary open source.

Appendix III-Working Group Members

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Senior Advisor Health Care Systems Management
Northrop Grumman IT
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* Robert Lantz's participation ceased on 4/1/2010 due to the Working Group Rule that only one member per company can participate. Further questions regarding VistA Working Group Participation can be addressed to IAC.

Chairman AKAKA. Thank you. It will be placed in the record. Now we will receive the testimony of Ms. Finn.

STATEMENT OF BELINDA J. FINN, ASSISTANT INSPECTOR GENERAL FOR AUDITS AND EVALUATIONS, OFFICE OF INSPECTOR GENERAL, U.S. DEPARTMENT OF VETERANS AFFAIRS

Ms. FINN. Thank you, Mr. Chairman and Members of the Committee. Thank you for the opportunity to discuss VA's management of its information technology projects. Mr. Mario Carbone, who is

with me today, is responsible for several of the audit reports I will be discussing.

The OIG has reported on the Department's management of its IT projects over recent years. My testimony today will summarize our work, highlight our insights regarding the IT governance structure, and discuss some key themes that we see reoccurring.

As part of our audit of VA's management of information technology capital investments, we examined VA's realignment of its IT program from a decentralized to a centralized management structure. We reported that the ad hoc manner in which the Office of Information and Technology, or OI&T, had managed the realignment had resulted in an environment with inconsistent management controls and inadequate oversight.

In September 2009, we reported that VA needed to manage its major IT development projects in a more disciplined and consistent manner. In general, we found that VA's processes were adequate. However, OI&T had not always communicated, complied with, or enforced its software development requirements. Once again, we attributed these management lapses to the centralization in an ad hoc manner.

Over the past 2 years, our audit work on several IT system development projects has identified problems with inadequate project and contract management, staffing shortages, and a lack of guidance. These recurring themes have repeatedly hindered OI&T's efforts to develop their systems.

For example, we have issued three reports on the Financial and Logistics Integrated Technology Enterprise. This is commonly known as FLITE. Our review of these programs concluded that program managers were repeating problems from the failed CoreFLS project. Specifically, the FLITE program managers did not always take well-timed actions to ensure the achievement of cost, schedule, and performance goals have sufficient staff in critical areas or clearly define staff roles and responsibilities; clearly define VA's training requirements for the pilot project; effectively identify and manage all risk associated with the Strategic Asset Management pilot project. This was a key component of the FLITE system.

We recommended that VA establish stronger program management controls to improve the deployment of the SAM pilot, beta, and national projects. Specifically, we recommended that the program establish controls to facilitate achieving cost, schedule, and performance goals, as well as mitigating program risk.

Finally, our audit of the Post-9/11 G.I. Bill Long Term Solution reported that OI&T had developed and deployed both LTS releases one and two on time. However, these releases did not always meet the functionality that was expected for those releases. We concluded that the program still needed more management discipline and processes to ensure the project meets both the performance and the cost goals required.

In conclusion, the Department historically has struggled to manage IT development projects to successfully deliver desired results within the cost and schedule constraints.

Mr. Chairman, thank you for the opportunity to be here today. We would be pleased to answer any questions that you or the other Members of the Committee may have.

[The prepared statement of Ms. Finn follows:]

PREPARED STATEMENT OF BELINDA J. FINN, ASSISTANT INSPECTOR GENERAL FOR AUDITS AND EVALUATIONS, OFFICE OF INSPECTOR GENERAL, U.S. DEPARTMENT OF VETERANS AFFAIRS

Mr. Chairman and Members of the Committee, thank you for the opportunity to discuss the Office of Inspector General's (OIG) findings regarding VA's management of its information technology (IT) projects. I am accompanied today by Mr. Mario Carbone, Director, Dallas Office of Audits and Evaluations, Office of Inspector General.

BACKGROUND

The use of IT is critical to VA providing a range of benefits and services to veterans, from medical care to compensation and pensions. If managed effectively, IT capital investments can significantly enhance operations to support the delivery of VA benefits and services.

However, when VA does not properly plan and manage its IT investments, they can become costly, risky, and counterproductive. As we have reported, IT management at VA is a longstanding high-risk area. Historically, VA has experienced significant challenges in managing its IT investments, including cost overruns, schedule slippages, performance problems, and in some cases, complete project failures. Some of VA's most costly failures have involved management of major IT system development projects awarded to contractor organizations.

My statement today focuses on the results of our audits of the Department's management of its IT projects over recent years. In summarizing this work, I will highlight initial insights regarding VA's IT governance structure and process and discuss some key themes that reoccur in VA's IT system developments.

IT GOVERNANCE CHALLENGES

In 2009, we provided an overarching view of VA's structure and process for IT investment management [*Audit of VA's Management of Information Technology Capital Investments* (Report No. 08–02679–134, May 29, 2009)]. As part of the audit, we examined VA's realignment of its IT program from a decentralized to a centralized management structure. The realignment was to provide greater accountability and control over VA resources by centralizing IT operations under the management of the Chief Information Officer (CIO) and standardizing operations using new processes based on industry best practices—goals that have only partially been fulfilled.

We reported that the ad hoc manner in which the Office of Information and Technology (OI&T) managed the realignment inadvertently resulted in an environment with inconsistent management controls and inadequate oversight. Although we conducted this audit more than two years after VA centralized its IT program, senior OI&T officials were still working to develop policies and procedures needed to effectively manage IT investments in a centralized environment. For example, OI&T had not clearly defined the roles of IT governance boards responsible for facilitating budget oversight and IT project management. OI&T also had not established the governance board criteria needed to select, review, and assess IT projects. OI&T does not expect to complete key elements of these new critical processes until FY 2011.

Further, in September 2009, we reported that VA needed to better manage its major IT development projects, valued at that time at over $3.4 billion, in a more disciplined and consistent manner [*Audit of VA's System Development Life Cycle Process* (Report No. 09–01239–232, September 30, 2009)]. In general, we found that VA's System Development Life Cycle (SDLC) processes were adequate and comparable to Federal standards. However, OI&T did not communicate, comply with, or enforce its mandatory software development requirements. OI&T did not ensure that required independent milestone reviews of VA's IT projects were conducted to identify and address system development and implementation issues. Once again, we attributed these management lapses to OI&T centralizing IT operations in an ad hoc manner, leaving little assurance that VA was making appropriate investment decisions and best use of available resources. Moreover, VA increased the risk that its IT projects would not meet cost, schedule, and performance goals, adversely affecting VA's ability to timely and adequately provide veterans health services and benefits.

These audits demonstrated that OI&T needed to implement effective centralized management controls over VA's IT investments. Specifically, we recommended that OI&T develop and issue a directive that communicated the mandatory requirements

of VA's SDLC process across the Department. We also recommended that OI&T implement controls to conduct continuous monitoring and enforce disciplined performance and quality reviews of the major programs and projects in VA's IT investment portfolio. Although OI&T concurred with our recommendations and provided acceptable plans of actions, OI&T's implementation of the corrective actions is not yet complete.

PROJECT MANAGEMENT SHORTFALLS IN RECENT YEARS

Over the past two years, our audit work on several IT system development projects has identified themes as to why VA has continued to fall short in its IT project management. These issues include inadequate project and contract management, staffing shortages, lack of guidance, and poor risk management—issues that have repeatedly hindered the success of IT major development projects undertaken by OI&T.

VA's Replacement Scheduling Application (RSA)

In August 2009, we reported that the RSA project failed because of ineffective planning and oversight [*Review of the Award and Administration of Task Orders Issued by the Department of Veterans Affairs for the Replacement Scheduling Application Development Program* (Report No. 09–01926–207, August 26, 2009)]. RSA was a multi-year project to replace the system the Veterans Health Administration used to schedule medical appointments for VA patients. Lacking defined requirements, an IT architecture, and a properly executed acquisition plan, RSA was at significant risk of failure from the start. We suggested that VA needed experienced personnel to plan and manage the development and implementation of complex IT projects effectively. We also suggested that a system to monitor and identify problems affecting the progress of projects could support VA's leadership in making effective and timely decisions to either redirect or terminate troubled projects.

Financial and Logistics Integrated Technology Enterprise (FLITE)

In September 2005, VA began developing the FLITE program to address the longstanding need for an integrated financial management system. As a successor to the failed Core Financial and Logistics System (CoreFLS), FLITE was a multi-year development effort comprised of three components: an Integrated Financial Accounting System (IFAS), Strategic Asset Management, and a Data Warehouse. FLITE was intended to provide timely and accurate financial, logistics, and asset management information. FLITE was also to resolve material weaknesses cited in the annual financial statement audit by integrating multiple systems and reducing manual accounting processes. In the past year, we issued three reports identifying project management shortcomings that hindered VA's efforts to accomplish the FLITE program's stated goals.

Audit of FLITE Program Management's Implementation of Lessons Learned

Our first report on FLITE determined that program managers did not fully incorporate lessons learned from the failed CoreFLS program to increase the probability of success in FLITE development [*Audit of FLITE Program Management's Implementation of Lessons Learned,* (Report No. 09–01467–216, September 16, 2009)]. We found deficiencies similar to those identified in CoreFLS reviews also occurred within FLITE because program managers had not implemented a systematic process to address lessons learned. For example, critical FLITE program functions were not fully staffed, non-FLITE expenditures were improperly funded through the FLITE program, and contract awards did not comply with competition requirements. We recommended that FLITE program managers develop written procedures to manage and monitor lessons learned and expedite actions to ensure full staffing of the FLITE program.

Audit of the FLITE Strategic Asset Management (SAM) Pilot Project

Our second report on the Strategic Asset Management (SAM) pilot project disclosed that FLITE program managers did not take well-timed actions to ensure VA achieved cost, schedule, and performance goals. Further, the contractor did not provide acceptable deliverables in a timely manner [*Audit of the FLITE Strategic Asset Management Pilot Project* (Report No. 09–03861–238, September 14, 2010)]. Once again, we identified instances where FLITE program managers could have avoided mistakes by paying closer attention to lessons learned from the CoreFLS effort.

Specifically, FLITE program managers:

• Awarded a task order on April 21, 2009 to General Dynamics for implementation of the SAM pilot project, even though the FLITE program suffered from a

known shortage of legacy system programmers critical to integration efforts required to make FLITE a success.

• Did not clearly define FLITE program and SAM pilot project roles and responsibilities, resulting in confusion and unclear communications between VA and General Dynamics. Contractor personnel indicated that they received directions and guidance from multiple sources. One of their biggest obstacles was trying to overcome the lack of one clear voice for VA's FLITE program.

• Did not ensure that the solicitation for the SAM pilot project clearly described VA's requirements for SAM end-user training. As such, VA contractually agreed to a training solution that did not meet its expectations. General Dynamics subsequently revised its training approach to meet VA's needs, but at a total cost of $1,090,175, which was more than a 300 percent increase from the original $244,451 training cost.

• Did not always effectively identify and manage risks associated with the SAM pilot project even though inadequate risk management had also been a problem with the failed CoreFLS. Specifically, FLITE program managers did not take steps early on to ensure that the contractor participated in the risk management process and that the Risk Control Review Board adequately mitigated risks before closing them.

Because of such issues, at the time of our audit, VA was considering extending the SAM pilot project by 17 months (from 12 to 29 months), potentially more than doubling the original contract cost of $8 million. We recommended that VA establish stronger program management controls to facilitate achieving cost, schedule, and performance goals, as well as mitigating risks related to the successful accomplishment of the SAM pilot project.

Review of Alleged Improper Program Management within the FLITE Strategic Asset Management Pilot Project

This third report, in response to a hotline allegation, disclosed that FLITE program managers needed to improve their overall management of the SAM pilot project [*Review of Alleged Improper Program Management within the FLITE Strategic Asset Management Pilot Project,* (Report No. 10–01374–237, September 7, 2010)]. FLITE program managers did not develop written procedures that clearly defined roles and responsibilities, provide timely guidance to program and contract staff, or foster an effective working environment within the FLITE program. FLITE program managers also did not ensure certain elements considered necessary for a successful software development effort, such as "to be" and architectural models were included as project deliverables in the FLITE program. In general, we recommended that VA strengthen project management controls to improve the SAM pilot, beta, and national deployment projects.

New Office of Management and Budget (OMB) guidance on financial systems IT projects, issued on June 28, 2010, also had a major impact on the FLITE Program. OMB issued the guidance because large-scale financial system modernization efforts undertaken by Federal agencies have historically led to complex project management requirements that are difficult to manage. Moreover, by the time the lengthy projects are finished, they are technologically obsolete. Consequently, OMB directed all Chief Financial Officer Act agencies immediately to halt the issuance of new procurements for financial system projects until it approves new project plans developed by the agencies. On July 12, 2010, VA's Assistant Secretary for Information and Technology announced the termination of IFAS and Data Warehouse portions of FLITE.

GI Bill Long Term Solution (LTS)

In September 2010, we reported that OI&T's plan for deployment of the LTS was effective in part [*Audit of VA's Implementation of the Post-9/11 GI Bill Long Term Solution,* (Report No. 10–00717–261, September 30, 2010)]. LTS is a fully automated claims processing system that utilizes a rules-based engine to process Post-9/11 GI Bill Chapter 33 veterans' education benefits.

OI&T developed and deployed both LTS Releases 1 and 2 on time. Lacking the management discipline and processes necessary to control performance and cost in project development, OI&T has relied upon Project Management Accountability System (PMAS) to achieve project scheduling goals. PMAS is VA's new IT management approach that focuses on achieving schedule objectives while the scope of functionality provided remains flexible. With this schedule-driven strategy, OI&T has been able to satisfy users and incrementally move VA forward in providing automated support for education benefits processing under the Post-9/11 GI Bill.

However, OI&T's achievement of the timeframes for LTS Releases 1 and 2 required that VA sacrifice much of the system functionality promised. Specifically, due

to unanticipated complexities in developing the system, OI&T deployed Release 1 as a "pilot" to approximately 16 claims examiners, with the functionality to handle only 15 percent of the Chapter 33 education claims that VBA anticipated processing. Release 2 caught up on the functionality postponed from Release 1, while providing the capability to process 95 percent of all Chapter 33 education claims. However, due to data structure and quality issues that still had to be overcome, users could not make use of all of the functionality provided through Release 2 and were able to process only 30 percent of all Chapter 33 education claims. In addition to these performance issues, OI&T did not have processes in place to track actual LTS project costs.

In the absence of effective performance and cost controls, OI&T runs the risk that future LTS releases may continue to meet schedule, but at the expense of performance and cost project goals. We recommended that OI&T improve LTS management by conducting periodic independent reviews to help identify and address system development and implementation issues as they arise. We also recommended that OI&T adopt cost control processes and tools to ensure accountability for LTS costs in accordance with Federal IT investment management requirements.

CONCLUSION

VA continues to rely on IT advancements to provide better services to our Nation's veterans. Historically, the department has struggled to manage IT developments that successfully deliver desired results within cost, schedule, and performance objectives. OI&T recently implemented PMAS to strengthen IT project management and improve the rate of success of VA's IT projects. Our oversight of the department's IT initiatives should provide valuable information to VA and Congress as the Department moves forward in managing its IT capital investments.

Mr. Chairman, this concludes my statement. I would be pleased to answer any questions that you or other Members of the Committee may have.

Chairman AKAKA. Thank you very much, Ms. Finn.

Now we will accept the testimony of Mr. Tullman.

STATEMENT OF GLEN TULLMAN, CHIEF EXECUTIVE OFFICER, ALLSCRIPTS

Mr. TULLMAN. Thank you, Mr. Chairman, thank you, Ranking Member Burr and other distinguished Members of the Committee. Thank you for the opportunity to share our perspectives on the use of health information technology within the Veterans Affairs Administration and the best path forward.

My name is Glen Tullman and I serve as the Chief Executive Officer of Allscripts. Allscripts is the largest provider of health information technology software that physicians, hospitals, and other caregivers use to manage care. We serve more than 180,000 physicians, 1,500 hospitals, and more than 10,000 post-acute care facilities and home care agencies who use Allscripts solutions to improve their clinical and business operations, and importantly, to connect with each other to provide care across health care stakeholders. Physicians and other health care professionals who use our systems in the civilian sector care for thousands of active duty and retired military personnel, and we process almost 3.5 million TRICARE claims each year.

In the 19 months since the passage of the HITECH Act, the conversation about health care information technology has been changed forever. It is my belief that we are at the beginning of the single fastest transformation of a major industry in the history of our country. Beyond the positive effect on hiring, which in our case equates to more than 600 new jobs since ARRA passed, new standards, certification, and the concept of meaningful use combined with incentives have combined with private sector ingenuity to cre-

ate a new best of breed in health care information technology platforms.

While the private sector has been moving forward in light of these incentives, the government has been investing in their own proprietary systems for many years. The VA system is made up of some of the country's best physicians and has played a critical role in demonstrating the value of technology, specifically electronic medical records. There is no question that VistA was a groundbreaking technology when it was first developed. However, today, things are different. The military is different. The care delivery model is different. And the technology is different. All of this necessitates a change.

The military has evolved, and during the Iraq and Afghanistan conflicts has drawn extensively from the civilian ranks, namely the National Guard. That flexibility poses a new requirement on electronic medical records. The ability to move those records around the world and between civilian and military systems is now a must, as compared with the past, where treatment was delivered mostly inside of the military and VA.

Just as the military has changed, so has the care delivery model. We are saving more wounded warriors. Military and VA providers are relying on advanced technologies and newly designed collaborative care models. Then, once home, many of our wounded soldiers are living examples of the fact that it is not just the surgery, but the rehabilitation that is critical. Complex patients require teams of physicians to drive successful outcomes, and the trends in the civilian world move toward Accountable Care Organizations, the Patient Centered Medical Home, and efficient care coordination as a means of improving quality and better managing cost will be critical for the military, as well.

Patients already increasingly move between the military health system, the VA, and the private sector, with physicians thus being required to manage patient hand-offs through the formation of care teams. It is clear that they need systems that can track, manage, and facilitate this communication.

Even with its strong start and the good work by Assistant Secretary Baker over the last year in trying to implement positive changes, the fact remained that VistA's basic platform, which relies on 25-year-old technology called MUMPS, cannot support the open, flexible approach needed to provide care to our Nation's wounded servicemen and women. Rather, the demands of today's military and veteran health care environment necessitates the use of technologies such as those based on Microsoft architecture and open source that can support an open, shared approach that will not just be desirable, but a fundamental requirement in the near future. A fitting analogy is the move the world made from a reliance on self-contained mainframes to a distributed flexible system like the Internet.

To optimize both care and cost, we need a system that easily and natively can talk with each other. Our belief is that usability and interoperability are core to the success of true IT adoption and should drive not only the development of individual products, but also the infrastructure underpinning health information technology exchange efforts.

Allscripts clients share information successfully today in the private sector with colleagues in the VA and the military health system. For example, in Hartford, CT, we have been partners with a project for almost 2 years that led to widespread health care IT adoption as well as successful implementation of open source health care information connectivity. Our partnership with Karen Fox and her team at Delta Health Care Alliance in Mississippi has enabled VHA to make substantial progress on information exchange. The University of Massachusetts is another example of fostering connectivity between communities and large organizations providing health care. Finally, last but not least, we are partnered with TeamPraxis, an organization based in Hawaii where we are connecting almost one-third of the physicians in Hawaii.

In the end, health care is about information and we simply cannot address the challenges the Nation is experiencing today in both private and public sector health care without ensuring providers have the information they need to make better decisions and the ability to communicate with others on a patient's care team, independent of the system they are using. It is time to learn from the successes in the private sector and make technology work for the Veterans Health Care Administration and the military health system.

So I want to thank you for the opportunity to share my thoughts today and I look forward to your questions.

[The prepared statement of Mr. Tullman follows:]

PREPARED STATEMENT OF GLEN TULLMAN, CHIEF EXECUTIVE OFFICER, ALLSCRIPTS

Chairman Akaka, Ranking Member Burr, and other distinguished Members of the Committee, thank you for the opportunity to share with you today our perspectives on the use of health information technology within the Veterans' Affairs Administration and the best path forward.

My name is Glen Tullman, and I serve as the Chief Executive Officer of Allscripts. Allscripts is the largest provider of health information technology software that physicians, hospitals and other caregivers use to manage patient care. Following our merger with Eclipsys in August, there are now more than 180,000 physicians, 1,500 hospitals and more than 10,000 post-acute care facilities and homecare agencies utilizing Allscripts solutions to improve their clinical and business operations and to connect to a variety of healthcare stakeholders. Allscripts is also the largest provider of electronic prescribing solutions, and through our revenue cycle management clearinghouse, we process more than 300 million claims, remittance and eligibility transactions each year.

Physicians and other healthcare professionals who use our systems in the civilian sector care for thousands of active duty and retired military personnel, and we process almost three-and-a-half million TRICARE claims each year. For example, in North Carolina, where one of every two physicians in the State is an Allscripts client, there are 750 physician practices using our systems while caring for the large local military population.

In the 19 months since the passage of the HITECH Act within the Stimulus legislation, the conversation about health information technology has been changed forever. It is my belief that we are at the beginning of the single fastest transformation of a major industry in the history of our country. Beyond the positive effect on hiring, which in our case equates to more than 600 new jobs since ARRA passed (most of which are in North Carolina, Illinois and Vermont), the incentives, along with new standards, certification, and the concept of Meaningful Use, have combined with private sector ingenuity to create a new "best-of-breed" in healthcare information technology platforms. The investment Congress and the Administration has made will lead to the delivery of better care, yield savings due to efficiency improvements, and markedly improve patient safety in the private sector.

While the private sector has been moving forward in light of these incentives, the Government has been investing in their own proprietary systems for many years. Billions of dollars have been spent to build and implement the VistA/CPRS system

within the Veteran Health Administration and the AHLTA system within the Military Health System.

The VA health system is made up some of the country's best physicians and has played a critical role in demonstrating the value of technology, specifically electronic medical records. There is no question that VistA was a groundbreaking technology when it was first developed, and over the years it has been improved with the development of CPRS, VistARad and other expansions. However, today things are different: the military is different. The care delivery model is different. And the technology is different. All of this necessitates a change. Let me explain.

The military has evolved significantly when compared to what existed even only a few years ago. It moves people around frequently, conducting joint exercises and, during the Iraq and Afghanistan conflicts, has drawn extensively from the civilian ranks, namely the National Guard. That flexibility is key to successes by the Armed Forces, but it also poses a new requirement of medical records—the ability to move those records around the world and between civilian and military systems is now a must, as compared to the past when most treatment was delivered inside of the military and VA systems.

Just as the military has changed, so has the care delivery model. First and foremost, we are saving more wounded warriors. Military and VA providers are relying on advanced technologies and newly-designed, collaborative care models. And, once home, many of our wounded soldiers are living examples of the fact that it isn't just surgery but rehabilitation that is critical. Complex patients require teams of physicians to drive successful outcomes, and the trends in the civilian world—the move to Accountable Care Organizations, the Patient Centered Medical Home and efficient care coordination as means of improving quality and better managing costs—will be critical for the military, as well. Patients already increasingly move between the Military Health System, the VA and private sector, with physicians thus being required to manage the patient hand-offs through the formation of care teams—either formal or informal—designed to ensure smooth care transitions. It is clear they need systems which can track, manage and facilitate this communication.

Even with its strong start and the good work by Assistant Secretary Baker over the last year in trying to implement positive change, the fact remains that VistA's basic platform, which relies on the 25-year old technology called Mumps, cannot support the open, flexible approach needed by those providing care to our Nation's wounded servicemen and women. Rather, the demands of today's military and veteran healthcare environment necessitate the use of technologies—such as those based on Microsoft's architecture—that can support an open, shared approach that will not just be desirable, but a fundamental requirement in the near future. A fitting analogy is the move the world made from reliance on self-contained mainframes to a distributed, flexible system like the Internet. The fact is, if you happen to live in one of the few areas with a closed healthcare system, merely moving healthcare records from paper silos into electronic silos—which is more or less what we've been doing for the last decade—can be made to work. But in the interconnected world that exists today, a closed system is not the norm for healthcare in the private sector, with patients moving from Point A to Point B to Point C, and increasingly, it is clear that the interchangeable requirements of the military environment means that a closed system approach simply isn't sufficient there, either. To optimize care and costs, we need systems that easily and natively talk with each other.

Unfortunately, attempts to share information between AHLTA and VistA have largely been unsuccessful. The North Chicago project—near my own home—is an example. Reports, including local newspapers, indicate that to date, the project has not achieved the goals set out of delivering interoperability between the two systems, with an exchange of medication information but no exchange of allergies, problems or clinical orders. We understand that physicians treating the patients who move between the two systems have, in many cases, resorted to housing two workstations in the exam room because of the double documentation that they are required to complete. It is simply not yet delivering on its potential, but it is my belief that coupling the focused effort to date with the right architecture and system design, as used in the private sector, could right the ship and deliver the results we seeking.

It is our belief that usability and interoperability are core to the success of true health IT adoption and should drive not only the development of individual products but also the infrastructure underpinning health information exchange efforts. Allscripts clients share information successfully today in the private sector and with colleagues in the VA and the military health system. For example, in Hartford, Connecticut, we have been partners in a project for almost two years that has not only led to widespread health IT adoption but successful implementation of open source health information exchange technologies. Our partnership with Karen Fox and her team at Delta Health Alliance in Mississippi has enabled DHA to make substantial

progress toward their goals of improving care through improved access to information. The University of Massachusetts is another example, not only fostering health IT adoption among local physicians in their area but also leading the state in connectivity efforts through an active exchange of information every single day. Allscripts is also working in the state of Vermont to facilitate Electronic Health Record adoption and deliver interoperability through a focused partnership with the Vermont Information Technology Leaders (VITL) project, one that has established a leadership position that other states in the country have chosen to emulate.

In the end, healthcare is about information, and we simply can't address the challenges the Nation is experiencing today in both private and public sector healthcare without ensuring that providers have the information they need to make better decisions, no matter where they're delivering care, and the ability to communicate with others on the patient's care team, independent of the system they are using. There is no one who would disagree that patients moving between providers and sites of care in the healthcare system deserve the best quality possible, which means that the information about the patient has to be available where it's needed, when it's needed. We can also agree that the government should lead the way by delivering world class healthcare to the Armed Forces of this Country and doing everything it can to make this happen in a timely and cost-efficient manner. It is time to learn from the successes of the private sector and make technology work for the Veterans Health Administration and the Military Health System.

I want to thank you for the opportunity to testify, and I look forward to your questions.

Chairman AKAKA. Thank you very much, Mr. Tullman.

Mr. TULLMAN. Thank you.

Chairman AKAKA. Now we will receive the testimony of Mr. Munnecke.

STATEMENT OF TOM MUNNECKE, FORMER INFORMATION TECHNOLOGY OFFICIAL, U.S. DEPARTMENT OF VETERANS AFFAIRS

Mr. MUNNECKE. Thank you very much, Chairman Akaka and Members of the Committee, for this opportunity to speak. I would also like to say that I sympathize with the Senator's complaints about the VA. As someone who has worked with or watched the VA for 32 years, I have many of my own complaints about the central office, but Roger Baker, I think, has a very good grip on the IT situation. I am impressed with what I hear he is doing so congratulations.

Thirty years ago, I was a computer specialist at the Loma Linda VA Hospital, working with a small group of programmers developing VistA. Things were at a fever pitch of innovation. Tens of thousands of VA employees from all over the country were connected on an electronic conferencing system which today would be called a social networking site. For any given issue, the VA had world class experts available that could be tapped internally. From this tiny seed, the VistA system flowered in one of the world's great medical information systems, as we see today.

At that time, under a VA/DOD sharing legislation set up by Representative Sonny Montgomery, Loma Linda and March Air Force Base made a local agreement to install a modified VistA at March Hospital. This was a successful case of VA-DOD information sharing dating back to 1983.

One of the key factors of the success of VistA was the decentralization and the direct day-to-day involvement of field-based VA clinical staff. The original developers all came from a clinical background and were deeply experienced in the nuances of medical

informatics. We were able to focus on medical needs rather than be distracted by the problems of administrative computing.

We designed the system to be an adaptive system, starting with good enough and then putting it out in the field for direct user involvement to make it better. We did not presume to know the final answer in advance, so we employed a generation's, not specifications, approach to controlling the system's evolution. We were a skunk works—replacing the bureaucratic procedures with a notion of creating a path of least resistance to our desired goal.

We used a language called MUMPS, a language that was designed specifically for medical informatics. This attracted much criticism at the time, which continues to this day. The DOD, VA, and Indian Health Service all enjoy, however, stable long-term electronic health records that are based on decentralized MUMPS, and in looking toward the future, I would suggest that we maintain an understanding of what did succeed in the past.

I would also caution the Committee that the electronic medical record systems are far more complex and specialized in their needs than standard IT applications. The open source technology that is proposed for the next generation of VistA is a very good move, I think, but I also want to suggest that the VA carry forward the lessons learned and the innovation learned with the VistA architecture to future architectures. Future technologies should not pave the cow path of replicating the old model, but rather support bold innovations in the delivery of care to our Nation's veterans.

One of the things I noticed when I first joined the VA was the difficulty of communicating across the stovepipes. I will call this a failure to communicate. I also noticed that one of the most highly used applications in the VistA system was the Mailman system—simply people communicating their clinical needs in an informal, person-to-person, peer-to-peer model. At some points, this reached 25 percent of a hospital's traffic. It was just people communicating.

So I want to strengthen the idea that part of the role of IT is to overcome this failure to communicate. There are rich opportunities for improving communications in general over and above the current focus on the medical record, which I think should be viewed as only one form of communication.

While VistA's success was based on the principles of decentralization, I would like to suggest that future systems be based on the notion of personalization, in which the veteran is at the center of their personal health care universe. Personalization includes the personalized health record, personalized medicine, personal genomics, home health care, telemedicine, and others. It also includes the role of social networks and building communities of health, which allows us to develop a positive health-oriented model that is integrated and balanced with the disease model we have today. Perhaps we might even achieve Jonas Salk's vision of creating an epidemic of health.

When Pierre Omidyar started eBay, he personalized the auction experience between millions of buyers and sellers. He did not try to integrate the auction industry. He provided the tools to connect the dots. I suggest that we envision a future consisting of a thriving Federal health care community personalized around the individual's health needs. Much can be done with simple, inexpensive,

and quick-to-implement tools that could reduce many of the public fears about privacy and open the system to innovation to deliver better care to our Nation's veterans.

Thank you very much for your time, and I look forward to answering any questions.

[The prepared statement of Mr. Munnecke follows:]

PREPARED STATEMENT OF TOM MUNNECKE, FORMER VA IT OFFICIAL

Thank you, Chairman Akaka, Ranking Member Burr, and Members of the Committee. As someone who has been passionately involved with health IT in the VA for 32 years, it is a pleasure to appear at this hearing to discuss the elements that led to success in VistA as well as how this might contribute to a Health IT system of the future.

Thanks to modern day communications technology, your staff reached me to invite me to this hearing during a vacation in the middle of Oregon's Cascades mountains. I only had one day at home to prepare for the hearing, so please understand that this is a rather hurried set of comments.

I was one of a small set of programmers hired by the VA in 1978 to work on an ANS MUMPS-based decentralized hospital computer system, what is now called VistA. I was a computer specialist employed at VA Loma Linda, California, working with a network of others around the country who pulled together a most remarkable effort to bring computing technology to clinical users in the VA. I was one of the lead software architects of the effort until 1986, when I went to Science Applications International Corporation in San Diego to play a similar role for the Composite Health Care System (CHCS) an adaptation of VistA. I was a consultant to VHA in the late 1990's in which I wrote a number of papers looking at future applications of IT in the VA (see Appendix). I took an early retirement as a VP and Chief Scientist at SAIC to pursue a broader field of philanthropic, humanitarian, and educational uses of technology, particularly with regard to those at the "bottom of the pyramid." I became a fellow at Stanford University, and was funded by Omidyar Foundation to develop a social network toolkit for philanthropic activities. I founded a group called the Uplift Academy, and have held workshops and salons around the world on the broader role of technology and society, including health care.

I appear at this Committee as a private citizen at my own expense, with the sole motivation of improving service to our veterans through appropriate uses of information technology.

Twenty-eight years ago, the Decentralized Hospital Computer Program (DHCP, later called VistA) was at a fever pitch of innovation. Tens of thousands of VA employees were connected on an electronic FORUM on a daily basis, sharing ideas, giving feedback, starting up new projects, complaining about others, and contributing in one way or another to the clinical application of computer technology to the delivery of service to our veterans. I would install a new version of the software one night, and the next day at the hospital cafeteria I would hear about what was good and what was bad about the changes. I would communicate these ideas to the developers via FORUM, and we would see changes in the software in hours or days. I installed a computer running VistA at the March Air Force Base hospital, an early instance of VA/DOD IT sharing.

Lesson Learned: Clinical information is vastly different from administrative information. One of VistA's strengths was that it was able to focus directly on the clinical.

VistA was developed directly as a clinical tool, by clinicians, for direct patient care. While there are many administrative needs of an enterprise for logistics, cost accounting, billing, payroll, and the like, these are a fundamentally different kind of computing.

Lesson Learned: Decentralization works. The extensive end-user collaboration was a key factor to the success of VistA.

When I first started at the VA, I ran into the bureaucratic "stovepipe" mentality everywhere I went, even though everyone had a supposedly common goal of providing health care to our veterans. Recalling the words of the Sheriff in Cool Hand Luke, it seemed that the core problem could be expressed as "What we have here is a failure to communicate."

In college, I was struck by the Sapir-Whorf hypothesis that language shapes our thought. I began to focus my attention on ways of using IT to overcome the failure to communicate. This led to the development of an integrated data dictionary that served as a "roadmap" to the patient data. Today, this would be called a "Semantic Web" (See http://www.caregraf.org/semanticvista for a modern semantic web inter-

face to the VistA database). We integrated electronic mail directly into the clinical interface, allowing database activities to generate email messages through an email/discussion/workflow system called MailMan. I was amazed at how heavily used MailMan was—in some cases, 25% of the traffic in a VistA system was email traffic. This demonstrated how communications-intensive clinical care is, even outside the formal communications traffic in the specific applications such as pharmacy, laboratory, or radiology. I think that VistA broke down many of the bureaucratic stovepipe barriers, allowing people to focus on what was best for their clinical practice.

Lesson Learned: The fundamental goal in health IT should be to improve communications. The medical record is but one form of communication.

All of the initial developers of VistA were employed in the field, working closely with end users. Riding the elevator with a gurney headed to the morgue was a sobering experience, and helped keep me focused on the implications of the software I was developing. The trust we placed in the VistA community was well-placed. People felt respected and acted accordingly, knowing that they were contributing to a larger, more successful whole.

The goal of our system was to produce a constantly improving, evolutionary system. Our goal was to get something "good enough" out into the field, and then begin the improvement process. We had neither money nor time for gold-plated requirements and specifications. Our motto was, "generations, not specifications." We didn't claim to know the end point of the system when we started, but rather created tools for users to adapt. Someone used to waterfall/requirements driven life cycle process might find this appalling—that users could interactively develop a system in tandem with developers—but it was a key factor to the success of VistA.

Lesson Learned: Generations, not Specifications. Start with "good enough" and allow it to continuously improve through end user interaction.

VistA was designed to be adaptable to change. When we began, we were using PDP–11 computers, which now exist only in museums. Over the years, the system was hosted on VAX, Alpha, IBM Mainframe, PowerPC, and Intel computers with little or no modification. VistA was designed around a "kernel" architecture, consisting of common foundation that was used by all applications, but customized for specific needs of the various departmental needs such as laboratory, pharmacy, radiology, etc. The closest modern day equivalent to this is Facebook, which provides all users with a common set of tools, and then allows them to install "apps" to do specific tasks. We used a trimmed down version of the ANS MUMPS language, using only 19 commands and 22 functions.

Lesson Learned: Create a Path of Least Resistance to where you want to go.

For example, at the 1978 Oklahoma City conference, we decided on a standard format for storing dates in the computer. We knew that some patients had been born in the 1900's, and we also knew that we would eventually be dealing with dates in the 2000's. We created a program that would handle dates in this way, making it easier to do it the right way. We had a design ethic of making it easier to do the right thing: creating a path of least resistance to where we wanted to go.

COMMENTS ON THE VISTA MODERNIZATION REPORT: FROM LEGACY TO LEADERSHIP

The report[1] is an impressive effort by a large number of committed industry advisors. I applaud the recommendation to move toward open source, and many of the recommendations.

However, I did not see the elements that lead to the success of VistA particularly well-represented in the report. The report focused on a heavily centralized, Washington-based development effort. User involvement was not stressed to the degree that it drove the original VistA development. It did not seem to fully recognize the unique needs of medical informatics, and seemed to make the all-to-common mistake of lumping clinical information with transaction-based administrative and billing systems.

COMMENTS ON MUMPS

Key to the success of VistA was the ANS MUMPS programming language. The Federal health IT systems that have been written have all been successful, stable systems: VistA, DOD's CHCS, IHS' RPMS. The Health IT systems that have been programmed in non-MUMPS languages (TRIMIS, IOCs, AHLTA) have been failures. Kaiser Permanente's EHR system is based on MUMPS (Epic), and a leading contender for the AHLTA replacement is also MUMPS-based.

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[1] http://www.actgov.org/sigcom/vistapublic/VistA%20Documents/VistA%20Modernization%20Report%20-%20Legacy%20to%20Leadership,%20May%204,%202010.pdf

Yes, MUMPS is an old language, but the fact that it has enjoyed all of this success bears close scrutiny by those seeking to replace it.

Question. Is the weakness of the current VistA due to MUMPS, or the VA's management of development process?

The report criticizes MUMPS as being a legacy system, as being brittle and difficult to maintain. However, VA Central Office has been responsible for the architecture for 25 years now, and has had 25 years to address these problems. Instead of investing in its basic infrastructure, it has deferred its maintenance reach the breaking point we see today.

If you asked a carpenter to build a house for you, and the house turned out to be crooked, you wouldn't accept the carpenter saying, "That darn hammer made the house crooked. You are going to have to buy me a better hammer." VA Central Office has been using a tool for 25 years, and rather than keeping it current and up to date, is now blaming the tool, not their management of it, for the problems we see today.

If indeed the VA needs to move away from a MUMPS-based architecture, it is imperative that it understands exactly what worked in the past. I think that this will require a deeper dive into the foundations of VistA to be fully appreciated.

Lesson Learned: VistA is not just computer screens.

VistA was an outpouring of creativity of thousands of VA employees working together to improve service to veterans. This created many bonds of innovation and a shared sense of purpose that drove the community. The report seems to reduce VistA to strictly an IT issue—replicating the screens of the old system. VistA needs a broader organizational context in order to thrive in the future.

Question. Is the VA just "paving the cowpaths" with new technology?

The recommendation that VA freeze development of the legacy system while engineering a new one that is functionally equivalent is a high-risk approach that threatens to stall IT innovation in the VA for a significant period. If the new approach is delayed or fails, the VA would be freezing itself out of innovation and years of new development.

LOOKING FORWARD

A mobile phone today has about 1000 times the computing and communications capacity of the computer I first used to install VistA at Loma Linda Hospital. It costs about one one-thousandth the price: a millionfold price-performance improvement. One would expect that this drop in the cost of the electronics would lead to a corresponding drop in the cost of Health IT. Internet users today have access to an incredible array of free services for email, social networking, photo and video sharing, text messaging, mailing lists, auction sites, and the ability to search billions of web pages instantly.

Unfortunately, this is not the case. Health IT costs are spirally upwards rapidly, and systems that used to cost millions in the 1980s are costing in the billions today.

Why is this? Why is it that costs outside of health IT are plummeting and functionality exploding, while the cost of health IT is exploding and the functionality creeping forward slowly, if at all?

Imagine someone trying to sell the world's greatest automobile. He offers the best car parts: an engine from a Corvette, the seats from a Rolls Royce, and a transmission from a Porsche. All that is required, he says, as a customer leaves with a truckload of these best of breed parts is "a little bit of integration."

So it is with Health IT today. Vendors are offering "best of breed" components (with corresponding premium prices) and then offering integration services to customize them to specific customer needs. Yet the integration costs—connecting the dots—are the overwhelming factor.

One way out of this is to reframe our thinking of IT architecture as a "space" rather than a "system." Consider what Tim Berners-Lee said about the creation of the World Wide Web:

> What was often difficult for people to understand about the design of the web was that there was nothing else beyond URLs, HTTP, and HTML. There was no central computer "controlling" the web, no single network on which these protocols worked, not even an organization anywhere that "ran" the Web. The web was not a physical "thing" that existed in a certain "place." It was a "space" in which information could exist."

This opens up an extremely fertile discussion on how health IT might be supported using web-like information structures, as well as reduce the complexity we see in our systems today.

I have written other papers on this topic (see Appendix). Some of the more directly pertinent papers include:

- HealthSpace architecture: http://munnecke.com/papers/HealthSpace.doc
- Ensembles and Transformations: http://munnecke.com/papers/D16.doc
- Concepts of the Health Data Vault: http://munnecke.com/papers/D03.doc

SUMMARY

VistA was an amazing outpouring of innovative collaboration within the VA that changed both its information technology and its organization. Decentralization and direct user involvement were key to its success, as well as having a technical infrastructure capable of supporting it.

Going forward, the VA should look to a theme of personalization of health—both in its IT infrastructure and its delivery of health care in today's rapidly changing environment.

I would be happy to answer any questions you may have now or from those reading this transcript.

APPENDIX:

These were papers relating to the future of Health IT in the VA that I wrote under contract to the VA from 1998 to 2000. A full list may be found on the web at http://munnecke.com/blog/?page—id=248

HealthSpace (139kb)	January, 1998	Some early thoughts on the notion of creating a ''space'' rather than a ''system'' of health.
Some Applications of Complexity Theory to Health Care (93kb)	December, 1998	Discusses the concepts of Dee Hock's ''Chaordic'' thinking to health care, as well as general complexity theory issues
Shared Meaning and Health Informatics (70kb)	January, 1999	Discusses some of the challenges of overspecific standards efforts, as well as some of the underlying philosophies.
Concepts of the Data Vault (57kb)	February, 1999	Introduces the notion of a personal data vault as a key component of a personal health space per patient.
From Enterprise to Person-Centric Health Information Systems(54kb)	April, 1999	Discusses the shift from enterprise-based health care to person-centric.
Health as a Medium (241kb)	May, 1999	Portrays health as a medium, and many health problems as a ''failure to communicate.''
Personalizing Health (107kb)	June, 1999	Discusses the issues of personalization at several levels
Steps towards an Epidemic of Health (95kb)	July, 1999	Discusses some of the initial conditions required to create an epidemic of health.
Design Patterns for Health (461kb)	August, 1999	Explores the application of architect/philosopher Christopher Alexander's ideas to health
New Health and the New Economy (67kb)	October, 1999	Compares a new vision of health with the ''New Rules of the New Economy'' book by Kevin Kelly
Rethinking Complexity (63kb)	November, 1999	Discusses issues of complexity and how to circumvent them using ''space'' metaphor.
Health and the Devil's Staircase (45kb)	January, 2000	Applies fractal thinking to health
Systemic Issues of Patient Safety (208kb)	March, 2000	Introduces a spectrum of scales to think about health, relates this to the notion of patient safety.

Tipping an Epidemic of Health (95kb)	May, 2000	Discusses why the connectivity provided by the Internet is on the verge of creating an epidemic of health
Ensembles and Transformations (23kb)	July, 2000	Introduces ensembles as communities of interest which provide a context for transformations.
Health and Positive Discourse (109kb)	August, 2000	Examines notions of Appreciative Inquiry, positive discourse, and optimism in light of Internet technology
Flipping from Negative to Positive Discourse (25k)	September, 2000	Examines the effects of negative discourse, how naming a problem can make it worse, and examples of positive discourse.
Assumptions of the Transactional Health Model	October, 2000	Examines some of the assumptions of the transactional model of health, such as linearity, the economics of scarcity, and deficit discourse.
A Transformational Notion of Health	November, 2000	Discusses transformational concepts in health, flipping assumptions of the above transformational model
New Perspectives	July, 2001	Discusses the inversion of enterprise/person relationship, complementary currencies, and HailStorm architecture(.pdf) (html)
Towards a language of Health (122K)	Nov, 2001	Proposes Genos, a language which would allow expression of health and genomic information for clinical use. (html) (pdf)
Can Health Care IT Adapt? (800K)	Jan, 2002	Discusses issues for adaptation in our information technology infrastructure, in light of prospective advances in Genomics and Proteomics (html)
From Systems to Spaces	June, 2002	A space-based metaphor for patient health information systems (htm) (pdf)

Chairman AKAKA. Thank you. Thank you very much, Mr. Munnecke.

Mr. Baker, what can you point out that would help persuade the Committee that VA has learned from its past and that we will not experience expensive IT project failures in the future?

Mr. BAKER. Thank you, Senator. I will keep this answer brief, because I would love to give you 10 minutes on that one. I think the biggest lesson that we took from the failure of the replacement scheduling application was that we have to make certain that the hard decisions are faced and made. From there, I think you have seen a series of hard decisions made at the VA relative to other projects. Stopping 45 projects in July of last year was, frankly, a hard decision for our customers, facing up that those projects were not delivering. Stopping some of those projects and just saying we are not going to be able to be successful at those, has been a series of hard decisions. Frankly, reforming a few of them was not viewed positively, but we recognized that they were not going to deliver if we did not change them to an incremental delivery.

Some of the more notable ones that I think we get criticized for, for example, stopping the FLITE program; they are hard decisions. They are not decisions that we take lightly and they are not decisions that we view from only one aspect. But in the end, we have to determine if we can be successful. If we believe, we cannot be, if we believe it is an overreach, we need to not do the program. So I would point you to not just some of the things we have done,

some of the programs we have instituted, but the results of those programs.

Most importantly, we do not allow a project to move forward today if they do not have a customer facing deliverable within the next 6 months. What that means is they are not going to go a long time, like the replacement scheduling project did. Replacement scheduling went years without delivering anything before they finally figured out it could not deliver anything.

We now are implementing a technique we are calling Fail Fast. You know, if it is going to fail, figure it out quickly and stop spending money on it. That has generated a lot of us facing up to those hard decisions, again, inside the organization.

So I would give you those two things. Again, in many ways, that is my life inside the VA, making certain we do not replicate those things from the past and that we do not have any more replacement scheduling scenarios.

One thing I would add is I have also promised Secretary Shinseki that we will not have another replacement scheduling while he and I are at the VA.

Chairman AKAKA. Well, let me give the other witnesses a chance to add anything about how to avoid these high-profile failures. Mr. Munnecke?

Mr. MUNNECKE. As a software architect being faced with these demands on the technical side, I find that the users—and this might come from Senate and Congressional committees, by the way—want to have the penthouse suite of a skyscraper, but they do not want to pay for the lower 22 floors and the foundation of the building. So they say, I want this thing up at the top. Give it to me tomorrow, or yesterday. Then everybody has to scramble to build the skyscraper. As an architect, I have to dig a hole in the ground to build a foundation. They say, no, no, I want the skyscraper. I want the penthouse suite.

So I think Mr. Baker's approach, which I wholly endorse, should also include the requirements that people who are building not make them gold-plated penthouse suites, but maybe even accept the tenth floor of an existing building and scale it down to allow it to evolve over time rather than go for the big push and the big bang that may not be possible. So it should be a process of discovery and working forward gracefully rather than expecting the gold-plated requirement to be met immediately.

Chairman AKAKA. Mr. Meagher?

Mr. MEAGHER. Thank you, sir. One thing I would add is this notion of accountability, personal accountability. When you have the projects broken up into small pieces where you make sure all the parts are in place before you begin: that there is an agreed-upon business requirement; there is a business owner; there is competent, experienced program management. Then you hold people accountable for their deliverables and for meeting their milestones. That is a culture change that is taking place, I would suggest to you, over the last 18 months that is very dramatic and is probably one of the main pillars to why I think you are seeing the turnaround that some of you have recognized and I really believe is there.

Chairman AKAKA. Mr. Tullman?

Mr. TULLMAN. Yes. I would again compliment Assistant Secretary Baker on the progress in what I heard today. You know, we believe that the private sector should play an increasingly large role in developing these systems. We are developing very similar systems for the civilian health care system, and increasingly what we are seeing is these two are meshing together. People are moving back and forth, in and out of the military and other services, and the government, as well.

So we would like to make sure that, number 1, the government is looking at what the private sector has to offer, and two, we believe that there are much better systems to form the community that my counterpart here talked about, a community of the VA. They are out there. There are social networking systems. There are open platforms. There are Microsoft-based systems. They are not based on what is essentially a 25-year-old transaction processing language called MUMPS. So we would like to see the new systems based on newer, broader standards and have the government in the role of setting the standards for what they want and let the private sector compete to deliver and be punished if they do not.

Chairman AKAKA. Let me now ask for questions from our Ranking Member, Senator Burr.

Senator BURR. Thank you, Mr. Chairman.

Mr. Baker, just a comment. You made the observation that as you cut IT programs, some of that money was reprogrammed over to operations and maintenance. At the same time as that is going on, we had savings in the construction of facilities area of which we are in the process of reprogramming over to build additional facilities.

I would only make this comment. VA continues to short operations and maintenance, year in and year out. Now, you are going to come back to us and you are going to ask for additional money for IT programs and we are going to feel compelled to give it to you. It is going to happen. We keep moving money around and we do not leave it where it not only does the most long-term good, but this reprogramming lets us off the hook from actually making the right decisions on operations and maintenance for this year, next year, every year.

So my hope is you will carry a message back. I, for one, as a Member of the Committee, am going to become much more observant of the reprogramming of money. If we get at the end of the year and we see money left over in your account, it will be because either, one, we projected wrong; two, we got savings; or three, we eliminated programs. We can reprogram that money for the next year so that it goes toward the program needs that you are going to have.

Let me stay with you, Mr. Baker. You listened to two competing views on future architecture, for MUMPS, against MUMPS. Who is right?

Mr. BAKER. Well, I guess being a political appointee, my job is to kind of run down the middle of this, and I do, technically. Several things come together from my standpoint here. One is an old adage that I have that the definition of a legacy system is that is the one you know works. We have——

Senator BURR. Let me just ask a follow-up question. If you maintain MUMPS, can the private sector have full access into the VA system, into the MUMPS system, for the exchange of electronic information?

Mr. BAKER. I would answer it this way. I believe just as much as if we implement it in any other language, because at the bottom, it is the data that is important.

Senator BURR. OK. Now let me turn to Mr. Tullman, if I can, simply because he is out there in the private sector. Now let us see what the limitation is.

Mr. TULLMAN. What I would say is, and again, I think you can extract data for any system. What we are really talking about, and I do not want to get too technical, is the native exchange of information. So you can pull information out of a mainframe system and put it into a PC if you want two people to talk to each other. The question is, why would you do that when you could have two PCs that were talking with each other?

So again, we think MUMPS was the right decision to make when it was made. We think there is a reason to carry forward. We are just saying, as we go forward into the future we need to broaden the understanding of what systems to use, what architectures to use, and what are the general reason we need these systems, and that is for communication. And I think that is this idea that this community is important, yet no one is using MUMPS to build systems that communicate and exchange data efficiently today——

Senator BURR. OK. Mr. Munnecke——

Mr. TULLMAN [continuing]. Anywhere else but the U.S. Government.

Senator BURR. What is wrong with two PCs?

Mr. MUNNECKE. Excuse me?

Senator BURR. What is wrong with two PCs?

Mr. MUNNECKE. Two PCs, that is basically the architecture we used. I was an avid anti-mainframe designer. We thought that mainframes were the devils and personal computers and microcomputers were the angels. I almost went to work for Apple Computer before I started at the VA and was a total fan of microcomputers. That was 1977. Mr. Tullman's comments have a number of technical issues that I think we need to talk about over coffee sometime. Yet, I probably largely agree with his conclusions.

I do not want to be characterized as being pro-MUMPS. I do want to be characterized as understanding that we have a very successful legacy system that has accomplished a lot, and just going with the standards of the information technology industry and thinking that we are going to take these shiny new technologies and buzzwords on PowerPoint presentations and come up with a successful system is not going to work. There are tremendous medical informatic needs that need to be dealt with, and dealing with them in a way that actually works and is on the ground and is working in IHS, DOD, and VA is quite a——

Senator BURR. I am not sure I have heard anybody describe an electronic health component of DOD actually working.

Mr. MUNNECKE. CHCS, Composite Health Care System, installed in 1986 in all facilities worldwide. We developed it at SAIC. That

was one of my projects. If you had somebody from DOD here that was using CHCS, I think they would have very good things——

Senator BURR. Well, why do they have such a hard time building medical records in a fashion that they can actually be transferred to VA?

Mr. MUNNECKE. I think that you would have to look at DOD actually throttling back CHCS and crippling the features that were designed into it for communication in order to protect their bureaucratic stovepipes. It is not a matter of technology. It was not MUMPS. It was the DOD's management of it and decision to centralize it and pull it apart and replace it with AHLTA.

Senator BURR. My time has run out, but let me just make one observation, if I can. There should be no committee of Congress that is trying to determine whether MUMPS is right or wrong, but I would say this to the VA: it is absolutely essential, in my estimation, that private sector companies buy into what technology decisions you make at VA because of exactly what Mr. Tullman raised, and that is that this is no longer our population of people that we are taking care of. They are bouncing back and forth, and that is going to happen for some time. As a matter of fact, they bounce back and forth today based upon what particular problem they have got and whether they want to be seen on the private sector side or whether they want to be seen on the VA side. So if we want to reach the efficiencies, long-term, of private health care, as most have realized, then we have got to have this interoperability solved.

So my observation would be, if a company like Allscripts, a leader, is questioning whether they will be able to exchange through your system, I think we ought to pause for a minute and talk to those companies and find out what their concerns are, how we overcome those concerns. There may be aspects that can be redesigned that overcome those. If, in fact, we end up at the end of the day and the private sector says, we cannot play in your world, well, we have got a big problem. The problem is we will not get as many efficiencies on the private sector side. And I certainly do not think that we will get efficiencies that we are going to have to get out of the VA side.

I thank the Chairman.

Chairman AKAKA. Thank you.

Senator Johanns?

Senator JOHANNS. Mr. Chairman, thank you.

I have to tell you, I am sitting here and it just brings back frightful memories. This is enormously expensive. Projects get abandoned. Huge costs to the taxpayers. Nothing to show for it while this debate goes on. And for us, I have to tell you that it is very, very frustrating. But again, I was in your position at one time.

Now, let me offer an observation or two, hopefully with a question. One observation I had about IT was that the process of creating a system was enormously influenced by a legislative process that was not connected at all to the IT requirements. I will give you a perfect example. Things would be written into the farm bill. They would have a nationwide impact, right down to the nuances of an individual farmer, yet the system was not able to deal with that.

So let me just start out and ask you, do you feel that kind of influence also at the Veterans Administration, or was that unique to USDA?

Mr. BAKER. From my observation, I would say we see it more on the benefits side than on the health side. One of the things that made the new G.I. Bill Long Term Solution a large-scale project was that there were substantial additions that are great features from the veterans' standpoint, and we fully support them, but they made the software much more complex than the software that processed the previous G.I. Bill, the previous educational benefits. Recognizing that we are going to see continued requests from Congress to enhance what that bill does for veterans, we have built it to be as flexible as possible. It is not perfect. Our answer is never going to be every time, sure, we can do that; no problem. But we have tried to build things in that would allow us to give an answer of, that will take a month or two versus that will take a year or two in——

Senator JOHANNS. So let me jump right in here, then, and ask another question. And it is OK to be critical of us. I mean, we are trying to figure this out. Even though we are your oversight, it is still OK to be critical.

Those policy determinations may be the absolute right policy, and I think we can all agree upon that, but is there a disconnect in the staff work driving that policy, or our work in driving that policy and the impact it has on the VA?

Mr. BAKER. There is an interesting balance in there, and I will reflect on——

Senator JOHANNS. You are being so diplomatic.

[Laughter.]

Mr. BAKER. Well, I am trying to give you the answer as I see it. I am a private sector person. These systems should not take forever to develop. So when the answer comes back to your staffers, "if you do that, it will take 3 years," they should not listen. At the same time, sometimes you get to the point where the answer really is, yes, that is going to take more than a year. We wrestled mightily with implementing the Chapter 33 system and a lot of it was because of the short timeframe to get it implemented, and then the fact that it was very popular with the folks using it. So we had a relatively poor IT system that VBA had to use in that first semester, which we saw the impact of. Veterans did not get paid in a timely fashion. With another year, we are able to implement the Long Term Solution and it is much better.

Senator JOHANNS. The other thing I wanted to ask you about—it is great to go home and tell people how we improved benefits. They are not quite as understanding when we tell them that we improved the funding for IT or bureaucrats to run it. Are you feeling that tension, also?

Mr. BAKER. Yes. It is certainly, as you point out, for example, easier to justify increases in the health accounts than in the IT accounts. Yet, as Dr. Petzel would tell you, because of how fundamental the VistA system and IT is to health, as they open a new facility, as they do new things for health, as they do the patient centered medical home, IT is fundamental.

We are constrained in our ability to meet the health demands by the fact that we are not tightly tied any longer. We have a separate appropriation for IT. We are wrestling with that, frankly, inside the VA right now and looking for what we can bring forward to Congress from a proposal standpoint that would let us address that issue without breaking down what we accomplished by centralizing IT management. It is what a private sector company would face directly. How do we most optimally do these things? Our difference is that instead of going to our CEO, we also go to our Board of Directors to do those sorts of things.

Senator JOHANNS. I will wrap up with this because I am out of time, also. One of the things that really, really came home to me when I was in your position—and you are serving this role now—is you need strong central management. It is just so obvious after doing what you are doing for about 3 years. You just need the very best person you can have in charge of this.

The second thing is, there has to be better coordination between the policymaking process and what you have to implement, because if there is a breakdown there, it can really cause serious problems.

Then, no offense to the private sector, because I agree, the private sector plays an important role here, but you have to have somebody who can push back, because my experience is they love to design the penthouse suite, to use the analogy. They are not so excited about designing the basement. And yet you have got to build the basement, the floors. It is kind of like building an interstate highway system. It is probably not the sexiest thing to acquire right-of-way, but guess what; if you do not have the right-of-way, you cannot lay the concrete. Everybody loves to see the concrete laid down.

So I think that it is enormously important that somebody there is very, very strong and knows their business, so the building blocks are there. Even if you do not get to the final epitome with that first contract, built a step at a time it just seems to go better and the money is better managed. Does that make sense?

Mr. BAKER. Absolutely. In software terms, we would call that incremental development. Show the customer something as quick as you can and get their feedback on whether it is what they want or not, and then build further to that. It is the way the private sector builds things. Government has traditionally done the big bang thing, which is tell me all your requirements. I will spend 5 years, I will wrap it up in a bow, and I will hand it to you. The problem is it does not account for something that we all know is a fact, which is change.

Senator JOHANNS. Yes.

Mr. BAKER. This is why so many large-scale government projects fail.

Senator JOHANNS. Thank you, Mr. Chairman, for your patience.

Chairman AKAKA. Thank you, Senator Johanns.

Senator Brown?

Senator BROWN OF MASSACHUSETTS. Thank you, Mr. Chairman.

You know, when I go home, people say, "Scott, have you changed? Have you changed at all?" And I say, well, yes, I have changed, because I have learned a lot doing my job and at the Committee hearings. As a matter of fact, I learned that the Arling-

ton Cemetery folks are still accounting for all the people on index cards. They are using index cards to identify where graves are and who is there. They do not have an iPad or they do not use computers. Can you believe that? It is amazing to me.

I have learned also that we waste a tremendous amount of money beginning programs, putting a few hundred million dollars in it, and then just say, oh, that does not work. We will do something else. I have learned also that the IT systems in the various departments are critical, especially with the changing nature of how we communicate worldwide, and I am not opposed to providing the tools and resources to update IT. I think it makes sense. But I do have a problem when we always—and I know I am still somewhat new here—but we put these tremendous amounts of money into programs and then we change course midstream, and do another one and another one.

So I guess my question ultimately is, are you satisfied at this point that you have the IT system in place to basically do your job?

Mr. BAKER. I am going to start by answering that from my private sector perspective, which is absolutely not. You know, this is a large still government-oriented organization. I am pleased with the progress we have made. I very early learned to separate our customer support and operations, which are on a par with the private sector, from our development, which is far behind what a private sector organization would do.

We are putting in the disciplines in our development organization that a private sector organization would expect, but frankly, we have nearly 3,000 developers. We spend about $800 million a year on development, and while we have started to change that organization, we are nowhere close to the level of output I would expect from that level of investment.

We will not have another $100 million "go off and spend money and fail" program in the VA. Like a private sector organization, we are going to have a lot of a few million dollar projects, to discover that is not the right program. Let us go do something different. We want to do speculative things, take some risks, find things that are going to be big wins, and stop things early before they turn into big losses. That is the way the private sector approaches these things.

But to come back fundamentally to your question, we are trying to get to the point where we can be compared to a good private sector organization. We are several years away from that at this point still.

Senator BROWN OF MASSACHUSETTS. Well, considering that, has your ability to hire and fire improved at all?

Mr. BAKER. No.

Senator BROWN OF MASSACHUSETTS. OK. And is there something that we can do to help you in that mission? Maybe offline, you can let us know so we can streamline and do whatever we need to do to give you that authority so you can get your house in order.

Mr. BAKER. Senator, I can certainly tell you what, as a CEO in the private sector, I had from an authority standpoint.

Senator BROWN OF MASSACHUSETTS. No, I understand that. I am——

Mr. BAKER. I long ago gave up being able to have the equivalent in the Federal Government.

Senator BROWN OF MASSACHUSETTS. All right. Well, maybe we can talk about that offline and figure out a way to help you get to where you need to be.

There is obviously an initiative by DOD to find a way to save $100 billion. What are you doing to try to save money, as well, because the money tree is getting smaller.

Mr. BAKER. I agree. I have been focused since I arrived at VA on making certain that the dollars we spend are spent on things that are going to benefit veterans, that we are not wasting the dollars. We requested no increase from fiscal year 2010 to fiscal year 2011. We will request no—I am sorry, I am not allowed to talk about the President's budget, but I would not anticipate the VA requesting an IT increase going into 2012, as well. My focus is on how we get more out of the dollars that we have. We have to deliver more things for the veterans, and I want to be careful to make certain that we are not cutting back in areas that we should not be cutting back, specifically to Senator Burr's comment about the maintenance and the operations and the infrastructure. But my main focus is on making certain that when we spend a dollar, we have got real return for that dollar inside VA.

Senator BROWN OF MASSACHUSETTS. That is appreciated. As a 30-year, almost 31-year Guardsman, if somebody is in the Guard and they deploy, then get home and decide they want to get out of the military, what assurances can you provide that his medical records from deployment and home station will be transferred to the VA CBOCs 3, 4, or 5 years down the line?

Mr. BAKER. From my understanding of that system, that is a great question.

Senator BROWN OF MASSACHUSETTS. That is why I asked it.

[Laughter.]

Mr. BAKER. Anything that is electronically generated inside the DOD comes to the VA through a system called the Federal Health Information Exchange. There is a lot of electronic information. I do not know the DOD system well enough to know how much of that Guard's information comes over in that system and how much of it does not come into that for the VA to see. I will be happy to get an answer on that one so that we both get a little bit better educated on what does occur and what does not occur.

Senator BROWN OF MASSACHUSETTS. Well, I think it is important because you have a tremendous amount of Guardsmen who are serving in the One Army concept, doing their time, getting out, and getting the appropriate care and treatment. If the records are not complete, it is a waste of time and money for a whole host of reasons, so thank you. If you could maybe get back to me; just call the office. You do not need to send anything. Just pick up the phone. It is a "keep it simple, stupid" type of thing.

Mr. BAKER. OK.

Senator BROWN OF MASSACHUSETTS. OK?

Mr. BAKER. I appreciate it. Thank you.

Senator BROWN OF MASSACHUSETTS. Thank you, sir. I appreciate it. Thank you, Mr. Chairman.

Chairman AKAKA. Thank you very much, Senator Brown.

Senator BROWN OF MASSACHUSETTS. I did not mean to say that you are stupid. It is the KISS theory, just so——

Mr. BAKER. I love the KISS theory.

Senator BROWN OF MASSACHUSETTS [continuing]. I am not misquoted. I think you are doing a very thorough job. So I just want to make sure——

[Laughter.]

Mr. BAKER. I took it as intended, sir. Thank you.

Senator BROWN OF MASSACHUSETTS. OK. Thank you.

Chairman AKAKA. Thank you very much, Senator Brown.

Mr. Baker, with the failure of CoreFLS, the Committee learned that the contractor was still paid a bonus due to contractual obligations. Are bonuses being used to encourage contractor performance, and how are they structured?

Mr. BAKER. To answer the first question, I am certain that there still are incentives in our contracts to encourage the contractor to do what we want them to do. My experience from both the private and the government sector sides are that there are frequently cost-plus-incentive fee contracts, and I expect that we would use those where appropriate.

The issue that you frequently see is when a contractor does exactly or close to exactly what the contract asks them to do and the project still fails for either reasons that they did not even contribute to or reasons that were not contemplated in the contract, and I think the government has fairly traditionally continued to pay those incentive fees when contractually required in those.

It is an interesting dilemma, because, if you will, the environment that a program exists in is multiple contractors, lots of different government offices, and as we have all seen, pinning the blame on who caused the failure inside the government programs is almost impossible. There are so many people involved, so many people insulate themselves from taking charge, that it is perfectly feasible for the contractor to say, I did what I told you I would do. I earned my incentive payment. Please pay me. Do I like it? No, but it is part of the contractual process.

Chairman AKAKA. For our other witnesses, do you have any thoughts on bonuses built into these IT contracts? Mr. Munnecke?

Mr. MUNNECKE. Well, as a VA employee who was demoted for my work with VistA, I think there is a lot to be said for aligning incentives to support innovation. I would like to focus on innovation and giving bonuses for innovation. I guess I would like to see innovation tracked as well as costs and budget.

Chairman AKAKA. Ms. Finn, with regard to the recent IG report on the G.I. Bill, why is it so important to have an independent milestone review in place, and also, does VA's solution fit the bill?

Ms. FINN. We believe the independent review is important because it helps people making decisions, like Mr. Baker, have a solid understanding of what is going on, separate from just the program managers' or the project managers' assertion of how things are going. It gets down to the facts of what is happening, where the costs are, how much things have cost, and what the progress really is.

The response from the Department was that although this has not been accomplished yet through the PMAS oversight process, it

is planned to be and will be part of future PMAS. That is a solution. We are still waiting to see how that works out. We are currently working on an audit of the PMAS system to take a closer look at the controls and the processes being used to oversee system developments. So, hopefully when we finish that, we will have better insight as to how well PMAS can fit the independent review portion.

Chairman AKAKA. For the other witnesses, should these independent reviews be done on some of the other large-scale projects, as well?

Mr. BAKER. Senator, I will just point out that one of our main philosophies is that we are looking to the customer to tell us whether they are getting what they are expecting from us, and that is an integral part of PMAS.

We have, I believe, an exceedingly good relationship with our IG folks on the technical side. We get very good constructive criticisms from them. It is extremely useful. I believe you will find, in general, with the recommendations they make to us these days, we are going to concur. We can take all the help we can get in making this work well. I appreciate the work that Ms. Finn and Mr. Carbone and their folks do for us. It helps.

Chairman AKAKA. Any others? Well, my time has expired.

Senator Burr?

Senator BURR. I got to thinking as Senator Brown held up his iPad. My last trip to Mid-Valley Hospital, as I saw kids come in from Landstuhl, I think all of them had their medical records taped to their belly. That is why I made the comment I did about DOD. I am sure there are some areas that do work. But I am also struck by the fact that I think three of our witnesses brought their iPads with them. I think that gives us a great indication as to how much most of you, if not all of you, look at the new technologies available that change the way you personally communicate. So I think the challenge, Mr. Baker, is to change the culture, not just at VA, I would say throughout government, though it may be a bridge too far.

My hope is that like we see business collaboration with academia that did not exist 20 years ago, we now see business collaboration with academia is an absolutely crucial component to where business chooses to invest capital because it is essential to their long-term viability of the business.

Again, my hope is that VA will collaborate with the private sector, not just from a contractual standpoint, but from a strategic and tactical standpoint with business, because when we both get on the same page, when we both agree with the platforms, when the highway goes to the same end place—you may have different exits on yours, the private sector may have different exits, but where you stop and where you end have to be one and the same. I think we will find that we can leverage things that we are currently not leveraging in our efforts.

Let me ask you about skilled staff. I think IT projects are a lot about staffing, and I would ask you, what is your assessment of the professional competence of the program managers within the office who manage these expensive and critical IT programs?

Mr. BAKER. Senator, one of the reasons that we have cut back on the number of projects that we are doing is because we do not have a sufficient amount of project management skills to run the number of projects that our customers would like us to compete. One of the primary premises of the Program Management Accountability System is we are not going to ask a project manager to start a project when he or she already knows it is going to fail. Those project management skills have proven to be where we are weakest, where we have the most trouble hiring, and where we compete most directly head-to-head on dollars with the private sector. A great project manager is worth every penny he or she is paid in what they save you in what they do in delivering a project.

Senator BURR. Do you have all the tools you need to improve the competency and the performance of your program managers?

Mr. BAKER. I would never say we have all the tools we need. We are doing a lot of training. We are doing a lot of hiring. But we need more than 100 good project managers at the VA right now. We are able to hire one or two at a time. It is difficult. Everybody needs them. And while we have a mission that I believe is more communicable than anybody else's, great project managers are in high demand in the private sector and in government.

Senator BURR. We currently have an RFP with IBM for the Agent Orange claims. What is the amount of that relationship with IBM for that project?

Mr. BAKER. I believe that is a firm fixed price at about $9 million.

Senator BURR. OK. The first 45-day mark, they missed.

Mr. BAKER. That is correct.

Senator BURR. You then issued a second, a back-up RFP.

Mr. BAKER. Correct.

Senator BURR. What is the reason IBM missed it?

Mr. BAKER. From our perspective, I do not believe they understood—just being blunt—they did not understand it was not "business as usual" in the government, that we were absolutely committed to making the 45-day mark from the VA's standpoint. Anecdotally—I will talk about this because I have read it in the press—I believe that they were probably surprised on day 46 that a Cabinet Secretary called the CEO and said, "I am concerned." That is not government as usual.

Senator BURR. I agree.

Mr. BAKER. We must process Agent Orange claims when they come in and demonstrate that we can do that effectively and that we can involve the private sector in doing that. I believe with the path IBM is on right now, they will succeed. I can assure you they got the message, and they have responded like you would expect from one of our Nation's leading technology companies.

We also, however, recognize that in this case, a reasonable probability of success may not be enough. We may need to have a back-up system that if for any reason they were not to deliver, we would have an alternative. We have not yet, to my knowledge, let that second RFP, but I believe that the motions that we made that were seen in the public probably are interpreted the right way, which is we are going to deliver this system.

Senator BURR. We both know we do not have any choice.

Mr. BAKER. That is right.

Senator BURR. If we do not, we will have an implosion of our claims processing, and I dare say we are close to that today anyway, and we both know that.

The Chairman is being awfully accommodating to me. Let me move to Mr. Tullman just real quick, because Allscripts has an extensive experience in electronic health services in the private sector, and I think you even commented in your testimony that you had processed, I think, 3.5 million or 3.5 trillion claims?

Mr. TULLMAN. Million.

Senator BURR. Million. Well, we are in Washington, so——

[Laughter.]

Senator BURR. I wondered if you could talk just a little bit about the partnerships Delta Health Alliance and the University of Massachusetts have and what lessons you learned from that which might assist the VA and DOD efforts in their quest for a seamless electronic medical records system.

Mr. TULLMAN. I would start off by saying that clearly the challenge that the VA has is a larger one than those that we will talk about with Delta Health Alliance or with University of Massachusetts. That said, the general principle was we were not going to put the patient between the interest of various bureaucracies that might be involved, and those could be—in both cases, we are talking about a variety of competitors actually exchanging information based on standards published by the government and, in fact, exceeding those standards. So what we have set up is an information exchange, private information exchanges that are secure. We have asked that each of the entities put aside the competitive aspects of what they do and look at the patient.

So I think the biggest message there was we went in with an objective that said, we have to exchange basic information across these systems. We have not always been able to use standard technology, so there we have applied new technologies from innovative companies like dbMotion, which allows us to essentially do semantic interoperability, which is allowing French, German, English all to connect into one virtual patient record.

So net/net, I think it has been both a technology accomplishment, and also one, as was mentioned earlier, that has to do with the politics of what goes on, because large academic medical centers in a variety of other community-based organizations do not always want to—it is not a natural act to communicate, but it has to be in health care. It is too important a problem. And as you mentioned, we cannot have especially our young service men and women not have full access to the information to allow our physicians to make better decisions.

So we have taken both a technology approach and also a political approach in terms of managing that and I think that is the same approach that we will need to take in the government.

Senator BURR. Thank you, Mr. Chairman.

Chairman AKAKA. Thank you very much, Senator Burr.

Mr. Baker, two points about VA's pharmacy program. First, medication safety is a priority for VA. Second, VA's pharmacy program is renowned for its delivery system. Many pharmacy IT solutions are critical, so I have two questions. What is the status of the

pharmacy reengineering project, and has there been any decision to cut funding for this project? And second, are you confident that the development for such a program is now on the right course?

Mr. BAKER. Senator, let me answer the second question first. Yes, I do. Pharmacy reengineering was one of the 45 projects we originally paused. I have frequently said that if you laid the schedule for Replacement Scheduling next to the one for Pharmacy and took the names off, you would not have been able to tell the difference.

Pharmacy, as you point out, is critical to us. What this application does is enhance our ability to detect drug interactions and avoid adverse impact from those drug interactions by using, frankly—by giving us access to private sector technology that now exceeds what we were able to develop inside the VA.

We right-sized that project and basically forced it to start delivering in one hospital. The Charleston, SC, hospital, is, I believe, the one where it is operational. It is either now or soon to be at more hospitals, basically following the same thing that Mr. Munnecke and the VistA developers did in the early days. Develop it in one, move it to more to prove out what it does, and then distribute it throughout the organization.

From a funding standpoint, I would tell you that I believe we have right-sized the program. I know that we spent $10 million less on it in 2010 than we had planned, but we delivered functionality to the schedule we established there. I would tell you that my belief as a computer scientist is that we could easily have spent that $10 million and gotten nothing more than we got out of the programs. I do believe we right-sized it.

I do not have the numbers for 2011 for that program right off the top of my head, but I believe we have the dollars allocated for it to move ahead on a path that will continue its success.

Chairman AKAKA. Mr. Baker, with respect to the lifetime electronic record, what discussions have taken place among members of the Joint Executive Council about the goal of the single or shared program that handles DOD and VA electronic medical records?

Mr. BAKER. Senator, I would tell you there are extensive discussions occurring almost every day on that topic between DOD and VA. I know that Deputy Secretary Gould, who is the VA Co-Chair along with Deputy Secretary Lynn of the DOD, has had discussions on that topic. We clearly would like to achieve that if possible, but there are mission differences between the DOD and the VA. The DOD right now is working on their electronic health record way ahead and I know that our future path for VistA is one of the options that they still consider to be a possibility. We certainly consider working with the DOD on a single record system to be something that we would like to do and we would like to figure out a way to do. But clearly, both of us must accomplish our missions as the primary goal.

Chairman AKAKA. Mr. Meagher, we have discussed a bit already about project management, but project management is a key to successful projects. What changes in IT project management have you seen within VA? Are these the right changes? Are more changes needed?

Mr. MEAGHER. Well, sir, I think the primary difference can be summed up in leadership and accountability. I think the substantiation of the PMAS system that Mr. Baker brought to the Department and the formalization of some of the rules of the road, these are things that are commonly understood to lead to success. So when you say you bring these things, you break the projects up into more manageable pieces. You make sure that there is a program manager and a business owner associated from the very beginning. You make sure the funding is adequate to the task. You make sure the milestones are reasonable and that they deliver results in our lifetimes so that the technology does not change while they are on a 3–5-year plan. You are familiar with how quickly technology does change.

So if you break these into 3- and 6-month increments, you make sure you have got the right people, you hold those people accountable, and you make—there is the old saying that "what gets measured gets managed"—so you have meaningful measures built in from the very beginning. Everyone understands. I think the example that you were discussing earlier about IBM, all of a sudden, everyone understands that the VA is serious now. They are not just mouthing platitudes. There will be consequences if you do not deliver according to the agreed-upon schedule.

Those leadership changes, and then the actual programmatic mechanics of it that have been put in place, I think have dramatically changed how VA is now capable of delivering. I think, as Roger said, you will not see any big failure coming out of the VA if they stick to the path they are on today. It will not be possible. If there is going to be any failure, it will be where they are taking risks, where they are trying innovative things. If it comes to pass that this is not within the capabilities or the realm of possibilities given current circumstances, you shut them down before they become too big to fail.

So I think the leadership and the focus on personal accountability, where a program manager knows they will be held accountable, their career will be affected if they do not deliver on time and on budget—I think is the biggest change—and having measured my time at the VA against what has happened in the last 18 months, I can only applaud the changes that have been made.

Chairman AKAKA. For the other witnesses, what can you share with us about VA's project management?

Ms. FINN. I will speak from a bit larger perspective. In project management, one of the things I see as positive is that when we work now within the Department, we are not arguing with OI&T or Mr. Baker and his staff about whether or not an issue exists based on the facts that we find. Sometimes we are discussing how best to address it, but we do not have resistance. So that kind of acceptance of input and information is critical to doing good project management.

Chairman AKAKA. Mr. Baker, on a scale of one to ten, what degree of confidence do you have that VA will make the December 31 deadline for the G.I. Bill Long Term Solution and what contingency plans are there should that deadline not be met?

Mr. BAKER. Senator, as you can imagine, we watch that one closely. I give at least a nine that we will make a delivery by De-

cember 31. The key question there is the inclusion of the financial payments interface in that delivery, and I would tell you that I have good confidence in that. Call that a seven-and-a-half to an eight. I am an experienced software developer. It is not going above nine until the customers are using it, as far as I am concerned. There are so many moving parts in any software development project of this scale that lots of things can go wrong. But I believe we have a good degree of confidence in what we have seen, in our ability to deliver in that area, and the realism of the project at this point.

Chairman AKAKA. In closing, I again want to thank all of our witnesses for appearing today. As Chairman, it is my responsibility to make certain that this Committee fulfills its obligation to conduct oversight of the Department of Veterans Affairs. How VA conducts its IT development impacts nearly every program and benefit veterans enjoy today. With the appropriate technology, management, and attention, I remain hopeful that VA will continue to be a leader and innovator in the area of health technology.

I thank you all for participating today. I would also like to acknowledge three VA leadership participants, Sylvia Tennent, Trenna Carter, and Timothy Graham, in the room today. I hope that the skills you have developed will aid you during your career at VA, especially those that will assist in improving VA's IT program.

The hearing is now adjourned.

[Whereupon, at 11:12 a.m., the Committee was adjourned.]

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